
THE WORLD WAR II ORDNANCE DEPARTMENT'S GOVERNMENT-OWNED CONTRACTOR-OPERATED (GOCO) INDUSTRIAL FACILITIES: INDIANA ARMY AMMUNITION PLANT HISTORIC INVESTIGATION

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by
**Steve Gaither
Kimberly L. Kane**

**U.S. ARMY MATERIEL COMMAND HISTORIC CONTEXT SERIES
REPORT OF INVESTIGATIONS
NUMBER 3A**



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**THE WORLD WAR II ORDNANCE DEPARTMENT'S
GOVERNMENT-OWNED CONTRACTOR-OPERATED
(GOCO) INDUSTRIAL FACILITIES:**

**INDIANA ARMY AMMUNITION PLANT
HISTORIC INVESTIGATION**

by
Steve Gaither
Kimberly L. Kane

Principal Investigator
Duane E. Peter

under
U.S. ARMY CORPS OF ENGINEERS
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U.S. ARMY MATERIEL COMMAND HISTORIC CONTEXT SERIES
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MANAGEMENT SUMMARY

This report presents the results of an examination of historical records related to the construction and operations of the Indiana Army Ammunition Plant (INAAP), Charlestown, Indiana. The project was undertaken by Geo-Marine, Inc. (GMI), during June, July, and August 1994. Duane Peter, Senior Archeologist of GMI, served as Principal Investigator. Steve Gaither, Assistant Archivist/Historian under Kimberly L. Kane, Archivist and Ethnologist/Historian, conducted the research. The historical context was developed through thorough research into the archives at INAAP, local libraries, and a series of oral history interviews.

This report demonstrates that INAAP was a unique facility in the Ordnance Department's Government-Owned Contractor-Operated industrial program designed to provide munitions and materiel for European and American forces during World War II. The facility was the first in the program to be funded by Congress and was an important producer throughout the war. The facility initially was two separate entities: Indiana Ordnance Works, which produced single-base smokeless powder and component chemicals used in its manufacture; and Hoosier Ordnance Plant, a bag manufacturing and load, assembly, and pack facility. A third portion of the facility, which was to have produced double-base smokeless propellant, Indiana Ordnance Works Plant 2, was never completed.

This report in addition discusses the direct and indirect effects construction and operations had on the small community of Charlestown, Indiana, which is located less than a kilometer from the present administration building. The sudden increase in the population which swept over the area inundated both administrators and the average citizen--forcing, on the one hand, government agencies to consider innovative measures in public administration to avoid impending crises, while on the other hand revitalizing the local economy. With the close of World War II, Charlestown resumed in part its quieter pre-war existence. But instead of a singular event, the first half of the 1940s has proven to be only the first of a series of economic and social ups and downs that the community has had to go through each time America has been involved in a military conflict.

TABLE OF CONTENTS

MANAGEMENT SUMMARY	iii
ACKNOWLEDGMENTS	xi
1. INTRODUCTION	1
2. OBJECTIVES AND METHODS	3
Statement of Objective	3
Methods	3
3. HISTORIC CONTEXT FOR INDIANA ARMY AMMUNITION PLANT, A WORLD WAR II ORDNANCE DEPARTMENT GOCO INDUSTRIAL FACILITY, 1939-1989	5
Introduction	5
The Military and Political Setting	11
The Ordnance Works System 1918 to 1940	11
Planning for the Installation	14
The Dual Nature of the CPFF Contract	15
The Indiana Ordnance Works--GOCO's World War II Beginning	16
Architectural and Engineering Design	16
The Du Pont Company	16
Plant Design--Under the Wire	17
Ranney Wells	18
The Construction Phase--The "First Wave" Rises in Indiana	26
The Operations Era	36
The Hoosier Ordnance Plant	45
Plant Design--Economy vs. Permanence	45
Cost Efficiency at Hoosier	46
Construction at HOP	58
Operations	63
The Goodyear Tire & Rubber Company	64
A Top GOCO Producer Goes Into Operation	65
The Indiana Ordnance Works Plant 2	76
Social History	77
Land Acquisition	77
Boomtown	80

Table of Contents
(cont'd)

The Setting	81
The Announcement Comes	82
Preparing for the Newcomers	83
Construction Begins	85
Housing	86
Food	88
Entertainment	88
Reaction of the Locals	90
Impact on the Town and its Infrastructure	90
Avoiding a Health Crisis	91
Utilities and Transportation	92
Housing	94
Education	95
Law Enforcement	95
Effects on the Local Economy	99
Wartime Operations	101
The Housing Shortage Continues	101
Transportation Improves	104
Law Enforcement	106
Labor and the Labor Shortage	107
Women in the Work Force	111
African-Americans in the Labor Force	113
Other Nationals and POWs in the Labor Force	115
Everyday Life at the Plants	118
Safety and Security	120
Absenteeism and Turnover	121
Efficiency	123
A Valuable Player in the War Effort	124
Entertainment	128
Environmental Legacy	128
Effects of the End of the War	129
The Post-War Years	130
Summary and Conclusions	133
REFERENCES CITED	135

LIST OF FIGURES

1. Location of INAAP in southern Indiana	6
2. Layout of Indiana Ordnance Works Plant 1	7
3. Layout of Hoosier Ordnance Plant	9
4. Charlestown, Indiana, ca. 1945	10
5. Elevations, Administration Building (Building 703), Indiana Ordnance Works Plant 1	19
6. Elevations, Main Cafeteria (Building 708-A), Indiana Ordnance Works Plant 1	20
7. Elevations, Fire Headquarters (Building 709-A), Indiana Ordnance Works Plant 1	21
8. East entrance elevation, Administration Building (Building 703), Indiana Ordnance Works Plant 1	22
9. Typical wall section, Administration Building (Building 703), Indiana Ordnance Works Plant 1	23
10. Main entrance elevation and section views, Main Cafeteria (Building 708-A), Indiana Ordnance Works Plant 1	24
11. Ranney Well Number 2 under construction	27
12. Pumpage and arrangement of radials in the Ranney Collector System	28
13. The INAAP area prior to construction	29
14. By January 1941, the steel skeletons for the power plant and a nitrating building in the 100 area were almost complete	31
15. Bricklayers at work on one of the power plants at Indiana Ordnance Works Plant 1	32
16. Construction era employment force chart for Indiana Ordnance Works Plant 1	33
17. View of the 100 Area of Indiana Ordnance Works Plant 1 shortly after completion	35
18. Axonometric diagram showing the manufacturing process for nitrocellulose	37
19. Equipment layout, Nitrating House (Building 103), Indiana Ordnance Works Plant 1	39
20. Diagram of a Loomis Press, used to compact nitrocellulose while adding alcohol to displace moisture	40
21. Equipment layout, Horizontal Pressing and Cutting House (Building 211), Indiana Ordnance Works Plant 1	41
22. Powder production at Indiana Ordnance Works Plant 1, beginning of operations to December 1942	42
23. Du Pont, Indiana Arsenal, and Ordnance Department employees, July 1945 through June 1946 ..	44
24. The bag manufacturing building group (buildings 1001, 1011, 1021, and 1031), Hoosier Ordnance Plant	48
25. Safety quantity distances for the LAP buildings at Hoosier Ordnance Plant	49
26. Safety quantity distances for buildings in a typical LAP building group at Hoosier Ordnance Plant	50

List of Figures
(cont'd)

27. Elevations, Administration Building (Building 2501), Hoosier Ordnance Plant	51
28. Building style 700-376 of the standardized Series 700 drawings of the Construction Division, Office of the Quartermaster General	53
29. Like the Administration Building (Building 2501) shown here, most buildings at the Hoosier Ordnance Plant were built with wood framing members	54
30. Elevation, Employment Building (Building 2511), Hoosier Ordnance Plant	55
31. Wall sections and details, Employment Building (Building 2501), Hoosier Ordnance Plant	56
32. Flow of material through the Bag Manufacturing Building (Building 1001) for the manufacture of 105 mm howitzer charges	67
33. Axonometric drawing showing the bag manufacturing process for 105 mm howitzer charges . . .	68
34. LAP building group, "A" side, Hoosier Ordnance Plant	69
35. Floor plan of the LAP buildings (buildings 3001-3017, excluding 3010), Hoosier Ordnance Plant	70
36. Arrangement of equipment in the LAP building loading booths, Hoosier Ordnance Plant	71
37. Operators weighing powder, placing the powder into increment bags, then sewing the bags shut in a loading booth, LAP Building, Hoosier Ordnance Plant	72
38. Using a gauge to check the length of a charge in the LAP Building, Hoosier Ordnance Plant . . .	74
39. Goodyear and Ordnance Department employee levels, beginning of operations through September 1942	75
40. Lining up at the bank on a crowded Charlestown street, construction era	84
41. Johnson's Trailer Camp	87
42. Charlestown's one tavern, where "every night was Saturday night and Saturday night was chaos"	89
43. Traffic, and parking, were problems in boom-town era Charlestown	93
44. Workers make deposits and cash paychecks at the First Bank of Charlestown	100
45. The Pleasant Ridge Housing Project, ca. 1946	103
46. Indiana Ordnance Works Plant 2, Workers Camp	105
47. Help wanted advertisement for Hoosier Ordnance Plant, 1943	109
48. Nationwide munitions production and industrial deferments, January 1942 to August 1945 . . .	110
49. Area 2 of the Workers' Camp for Indiana Ordnance Works Plant 2 construction employees . . .	117
50. German POWs help with construction at Indiana Ordnance Works Plant 2	119
51. Employees were searched for matches before entering the plants	122
52. Defense workers at these and other munitions plants were portrayed as soldiers on the industrial front	126
53. Employees at both plants were encouraged to make suggestions	127

LIST OF TABLES

1. Construction Costs for Selected Buildings at HOP and IOW #1	57
2. Building Completion Schedule at Hoosier Ordnance Works	62
3. Appraisals and Purchase Prices for Select Tracts at HOP	79
4. Growth and Decline of the Charlestown Population	81
5. State Police Traffic Arrests	96
6. State Police Criminal and Misdemeanor Arrests, March through September, 1941	97
7. Traffic Enforcement by State Police, March-December 1941, Charlestown Post	98
8. Houses in the Pleasant Ridge Subdivision	102
9. Temporary Barracks for Indiana Ordnance Works Plant 2 Construction Workers	106
10. Male and Female Employees at IOW #1 and HOP	113
11. Euro-American and African-American Employees at Indiana Ordnance Works	115
12. Partial Inventory of Indiana Arsenal, June 1946	131
13. Production Figures for World War II and the Korean War, HOP	132

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We would like to thank Joseph Murphey of the U.S. Army Corps of Engineers, Fort Worth District, who was most supportive of our efforts. He provided constructive criticism and management direction throughout this project. In the Geo-Marine, Inc., office in Plano, the final editing and overall production of the report were the responsibilities of Sharlene Allday. Denise Pemberton generated the computerized format for the layout and design of the book.

CHAPTER 1

INTRODUCTION

This report presents the results of research into the historical record of the Indiana Army Ammunition Plant (INAAP), Charlestown, Indiana. The purpose of this report is to partially fulfill the goals of a larger project that entails not only this specific historic investigation, but also a national context for the World War II Ordnance Department's Government-Owned Contractor-Operated (GOCO) industrial facilities, 1939-1945 (Kane 1995); detailed investigations into the history of seven former World War II-era Ordnance Department GOCO industrial facilities (present-day Badger, Joliet, Indiana, Kansas, Radford, Ravenna, and Twin Cities army ammunition plants); and photographic documentation of the same sample installations. Goals of the larger project included investigation and documentation of World War II and pre-World War II buildings and structures now under the jurisdiction of Army Materiel Command (AMC) as part of a Legacy Resource demonstration program of assistance to small installations, as well as the completion of mitigation efforts stipulated in a 1993 Programmatic Agreement among the AMC, the Advisory Council on Historic Preservation, and multiple State Historic Preservation Officers concerning a program to cease maintenance, excess, and dispose of particular properties. The detailed historic investigation of the Indiana Army Ammunition Plant, like the detailed historic investigations for the other sample installations, was undertaken in order to develop the national historical context on a state and local level. Its major focus was upon the impacts of the facility on state and local history.

In September 1993, Geo-Marine, Inc. (GMI), was contracted by the Army Corps of Engineers, Fort Worth District, to complete the national historic context, detailed historic investigations, and photographic documentation. The research for the Indiana Army Ammunition Plant detailed historic investigation was conducted by GMI during June, July, and August 1994. Duane Peter, Director of the Cultural Resources Division at GMI, served as Principal Investigator. Steve Gaither, Assistant Archivist/Historian under Kimberly L. Kane, Archivist-Historian/Ethnographer, conducted the research. The work was performed under Delivery Order No. 014 of Contract No. DACA63-93-D-0014.

The historical context portion of this report is divided into two primary sections. The first includes chapters discussing the military and political setting and a detailed description of the construction and World War II-era operations of the two facilities that were combined to create INAAP at the end of the war. Brief histories of the two primary contracting operators, E. I. du Pont de Nemours & Company and the Goodyear Tire & Rubber Company, are included in their respective sections. Particular attention is paid to the change in design strategy on the part of the War Department which, in order to save money, resulted in the construction of semi-permanent structures at Hoosier Ordnance Plant (HOP) in contrast to the permanent structures at Indiana Ordnance Works (IOW).

The second of the two primary sections discusses the impact the plants had on the surrounding communities, mainly Charlestown, located just northwest of the IOW administration area. This discussion looks at how town, county, and state governments dealt with the population increase, especially in the area of public health, the most serious threat to the well-being of the local populace. It also discusses the reactions of the local population and the integration of non-traditional elements (women, African-Americans, and war prisoners) into the labor force. The last chapters concern the effects of the end of the war and continuing impact of the facility.

CHAPTER 2

OBJECTIVES AND METHODS

STATEMENT OF OBJECTIVE

The primary goal of the investigation at INAAP, Charlestown, Indiana, as set forth in the Scope of Work (1993:4), was to "provide [an] understanding of the World War II military-industrial complex through detailed examination of the sample installations [INAAP is one of seven], expanding the national historic context." The focus of the investigation was "on World War II social issues of state and local significance, . . . [including] 1.) Controversies over Government acquisition of the land, 2.) How the change in the labor base affected of the [sic] local areas, 3.) Impacts women and blacks had in the local work force, etc." (SOW 1993:4). These efforts are undertaken to partially fulfill objectives of the overall project, which are to "research and document World War II and earlier buildings and structures at a number of ammunition plants under the jurisdiction of the Army Materiel Command (AMC) as a Legacy Resource Program demonstration project for assistance to small installations" and to "fulfill mitigation efforts of a 1993 Programmatic Agreement among the AMC, the Advisory Council on Historic Preservation, and Multiple State Historic Preservation Officers concerning a program to cease maintenance, excess, and dispose of certain properties" (SOW 1993:1).

METHODS

The INAAP, originally three separate facilities, was constructed between 1940 and 1945. The first of the three was the smokeless powder plant, the Indiana Ordnance Works Plant 1; the second was the bag manufacturing and load, assembly, and pack facility, the Hoosier Ordnance Plant; the last facility, never completed, was to be a rocket propellant plant, Indiana Ordnance Works Plant 2. These three facilities were part of a nation-wide effort that would initially provide arms and ammunition to the European Allied forces and later to those forces and Americans fighting on the European and Pacific fronts during World War II. To help the reader understand how INAAP fit into the national plan, a brief introduction to the national setting has been incorporated in this report; for a more detailed account, the reader is referred to the first volume in this series, *Historical Context for the World War II Ordnance Department's Government-Owned Contractor-Operated Industrial Facilities, 1939-1989*.

Standard bibliographies of military history, engineering, and the applied sciences, as well as the bibliographies of other relevant reports were consulted to identify published sources of information. Unpublished sources were identified through research at the Suitland Reference Branch of the National

Archives and at the Command Historical Office of the U.S. Army Armament, Munitions and Chemical Command (AMCCOM) at Rock Island Arsenal, Rock Island, Illinois.

The three facilities themselves were the primary foci of research. The search for published sources dealing with the history and technology of the plants involved research at the Charlestown Clark County Public Library in Charlestown, Indiana; the Jeffersonville Public Library in Jeffersonville, Indiana; and the government and contractor archives at INAAP. The effort to locate unpublished sources involved these same localities as well as the collection of David Hackel, who has worked at INAAP and has a special interest in that and other government-owned contractor-operated (GOCO) facilities in the U.S.

The archives at INAAP proved to be the most abundant source of information. The Administration Building vault contained drawings of most buildings at the facility, which provided a basis for comparing permanent and temporary construction at Indiana Ordnance Works and Hoosier Ordnance Plant. Also at INAAP were drawings that provided information about the Indiana Ordnance Works Plant 2 workers' camp and war prisoners' camp which has not been found anywhere else. Room numbers 7, 28, and 32 contained a wealth of data pertinent to construction and operations at the three facilities. There were also many original photographs dating to as early as 1940 at the facility.

As with any research that gathers figures and information set down over a long period of time by many different authors, there will be some contradictions and inconsistencies, due in part to typographic error. Every effort was made to resolve these as they appeared and include herein only the most accurate information. Notations cite unresolved and sometimes revealing inconsistencies in the historic record.

To supplement the information gathered from textual material, five oral history interviews were conducted. Four of the subjects were residents of the area prior to the beginning of construction. Three of these interviewees worked at the plant during World War II. Julius Hock, born ca. 1911, has lived in the Charlestown area since he was two. He worked for Du Pont during the construction era and as a safety inspector during operations. He continued to work for the various operators until he retired. Ed Howard, who has lived in the area all his life, was an excellent source of information. His clear recollection of his various duties during construction, which included serving as the mechanical engineer for the 100 area; of his work in the 200 area during operations; and of life in general within and without the plant was of great benefit to this project. Anita Richey provided a slightly different perspective of the facility during its early years of operation when she worked for the Ordnance Department. Since the scope of this project involved looking not only at the plant itself but also at the ways in which the plant affected life in Charlestown, a fourth subject was chosen who did not work at the plant. Harry Payne was the owner of Payne's Barber Shop at the corner of Market and Main streets in the center of Charlestown and had been a resident of the town for some years when the plans to build the facility were announced. The fifth interviewee moved into the area. Charles McVicker was sent by Miller Construction, for whom he worked, to Charlestown to help with the construction of the facility. Miller Construction had been awarded a subcontract for electrical work at the site. All of these interviewees provided a valuable and much appreciated counterpoint to the written documentation compiled during research for this project.

Further information was acquired through informal interviews with persons currently associated with the facility. Local historian David Hackel shared his knowledge of both this and other GOCO facilities, as well as his files on the Charlestown plant. Tamsie Meurer, Director and Historian of the Charlestown Clark County Public Library, provided information about Charlestown during the war. Jim Potter, a former draftsman at INAAP, provided information about building designs. And finally, Bob Roberts, a long-time employee of one of the companies involved in construction, was able to contribute some details about the organization of the partnership that built the Indiana Ordnance Works Plant 1.

CHAPTER 3

HISTORIC CONTEXT FOR INDIANA ARMY AMMUNITION PLANT, A WORLD WAR II ORDNANCE DEPARTMENT GOCO INDUSTRIAL FACILITY, 1939-1989

INTRODUCTION

The INAAP today encompasses 4,310 ha (10,650 ac) and is situated in southern Indiana, bounded by the Ohio River on the east and U. S. Highway 62 on the west (Figure 1). On the west side of Highway 62, northwest of the current administration building for the facility, lies the community of Charlestown, which at the time of the 1990 census had a population of almost 6,000. The land here is a gently rolling plateau 30 to 50 m above the Ohio River, much of which is open fields and pastures across which a number of small streams flow eastward and southeastward to the Ohio River. The plant area is situated about 24 km (15 mi) north of Louisville, Kentucky, a major population center in the region.

There were three major phases of construction at INAAP. The first phase, which began August 26, 1940, saw the completion of the original Indiana Ordnance Works Plant 1 (IOW #1), the first single-base smokeless powder plant that the National Defense Program authorized¹ and a model for similar facilities (Figure 2). A Chinese delegation even visited the facility to see how it was set up and to attend training classes in smokeless powder production. The contract to construct and then operate this installation was awarded to E. I. du Pont de Nemours & Company only a month before construction began. Du Pont, which had long been involved in the manufacture of dynamite and gunpowder, completed the plant in May 1942. Built largely of brick and steel, IOW #1 was one of the most permanent facilities constructed in the defense buildup program. Powder had been coming off the line a year before the plant was officially finished, with the first powder lot being produced on May 8, 1941 (Indiana Army Ammunition Plant [INAAP] [1963]:9-10).

¹ Although IOW #1 is generally thought of as the first World War II-era smokeless powder plant, that statement must be qualified as the first *authorized* by the Ordnance Department. Du Pont was already working under a private contract with the Anglo-French Purchasing Board to construct, maintain, and operate an explosives plant at Millington, Tennessee, signed June 10, more than a month earlier. The plant, the Tennessee Powder Company, was transferred to the War Department February 1, 1942 and renamed the Chickasaw Ordnance Works. The buildings there are temporary structures and its output was far less than that of IOW #1. Smokeless powder production at Chickasaw averaged 45,359 to 54,431 kg (100,000 to 120,000 lb) per day, whereas that of IOW #1 averaged 362,874 and 408,233 kg (800,000 and 900,000 lb) per day during peak production in 1942 (Myers 1992:19).

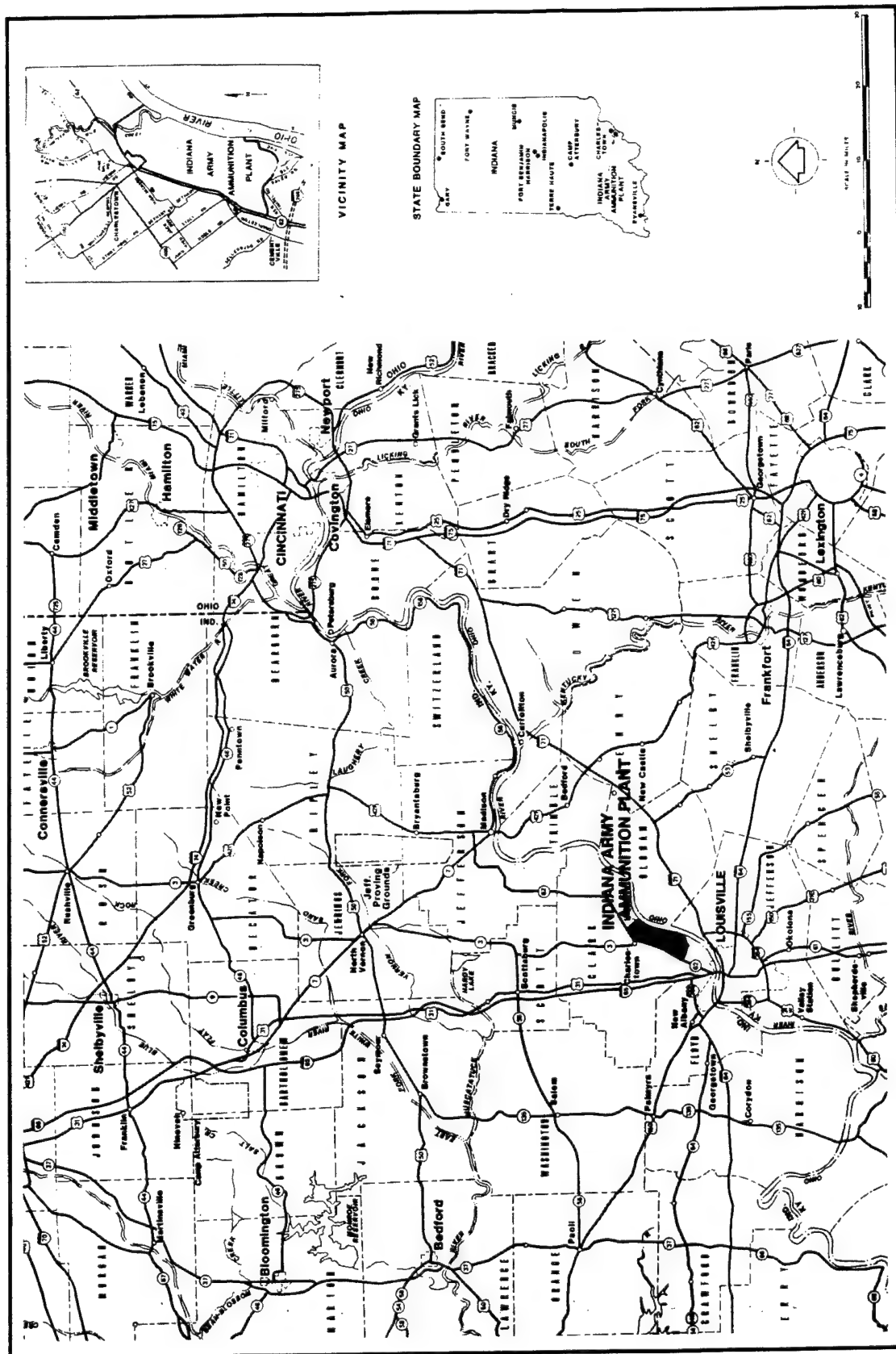


Figure 1. Location of INAAP in southern Indiana (INAAP Drawing 18-05-01, Sheet 1).

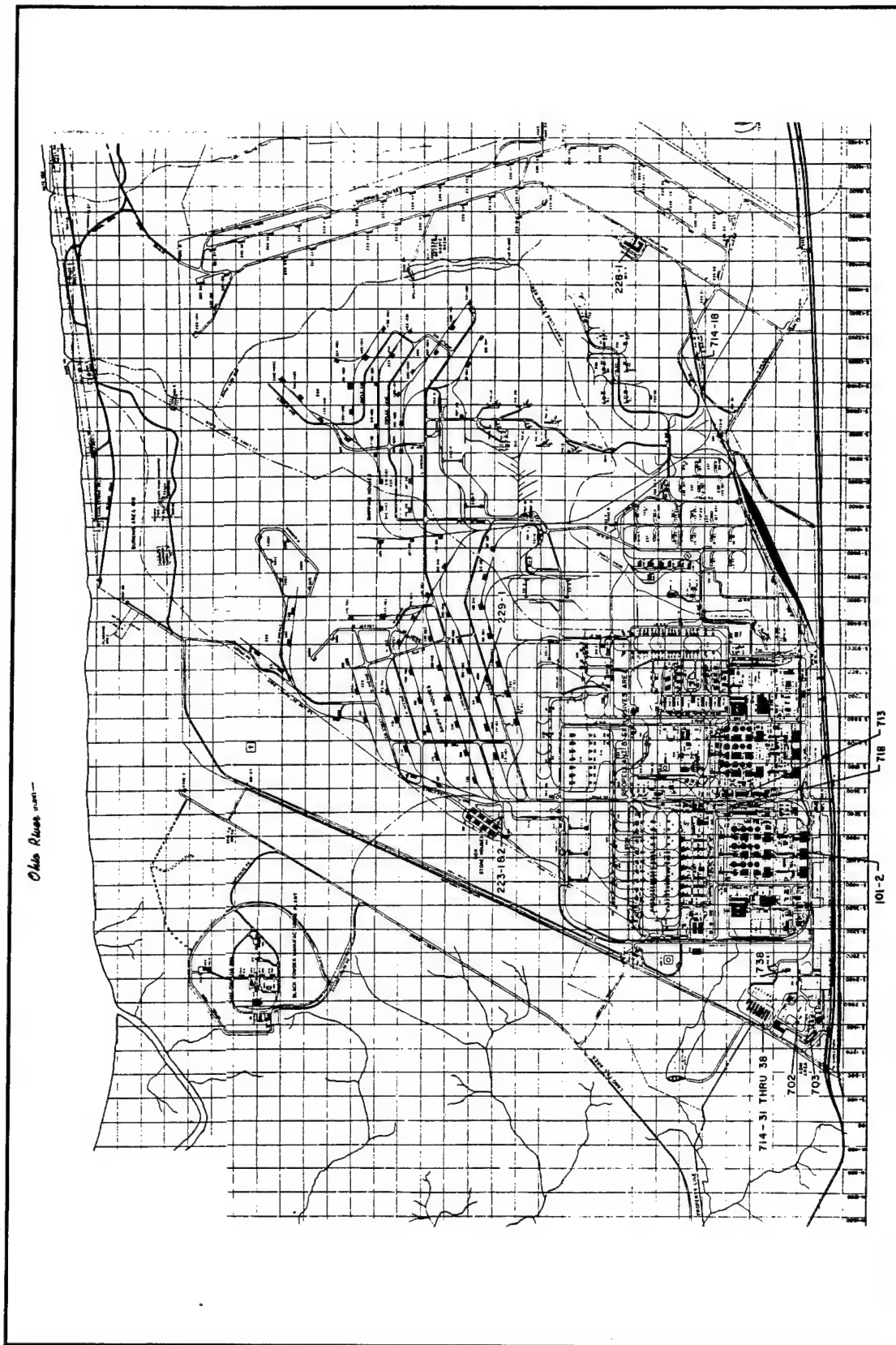


Figure 2. Layout of Indiana Ordnance Works Plant 1 (INAAP Drawing 400-900-100).

The second phase entailed the construction of what was originally called the Hoosier Ordnance Plant (HOP), the load, assembly, pack portion of the facility (Figure 3). Land acquisitions for this project extended the boundary of the facility southward, more than doubling the size of the original project area by adding another 2,023 ha (5,000 ac). Placing this plant here also increased efficiency by establishing a load, assembly, and pack (LAP) facility with the ability to prepare artillery, cannon, and mortar projectiles immediately next to the powder manufacturing facility at IOW #1. Equipment was to be procured and the facility run by Goodyear Engineering Corporation, an Indiana subsidiary of the Goodyear Tire & Rubber Company (HOP [1942]b:5). On December 28, 1940, the “design and engineering management of construction” at HOP was contracted to Shreve, Anderson and Walker, Engineers and Architects, a corporation with home offices in Detroit, Michigan (HOP [1942]b:5). This firm designed some of the main buildings, including bag loading buildings and the 1.6 ha (4 ac) bag manufacturing building. Other buildings such as the Administration Building, fire stations, and cafeterias were modified versions of standard drawings completed by the Construction Division of the Army and the Quartermaster Corps during the 1930s. Unlike IOW #1, HOP was of temporary or semi-permanent construction. Cost-cutting measures at the Ordnance Department forced all plans for permanent facilities to be downgraded, with steel and brick to be used only where it was not practical to use other materials. The construction contract was awarded to the four-firm partnership of Winston Brothers Company; C. F. Haglin and Sons, Inc.; Missouri Valley Bridge and Iron Company; and Sollitt Construction Company, Inc. Construction at this site began February 5, 1941 and ended January 31, 1942, with the plant going into operation on September 2, 1941, slightly before the facility was completed.

The third phase of construction was not begun until near the end of World War II. On the last day of October 1944, Du Pont was issued a change order giving it the go-ahead for the construction of a rocket propellant plant, Indiana Ordnance Works Plant 2 (IOW #2). The plant was to have had three lines producing double-base smokeless powder. Basic operations would have been the manufacture of nitroglycerine to be mixed with nitrocellulose to form a paste, which would be shaped into forms to be used as rocket propellant. Due to the high volatility of nitroglycerine, nearly 3,200 ha (8,000 ac) of land was required for IOW #2, the acquisition of which almost doubled the size of the overall facility once again. Construction began December 8, 1944, and a small amount of propellant was processed in July and August of the next year. However, at the end of August, two weeks after Japan surrendered, all operations ceased. IOW #2 was never completed.

The first two plants were vital components of the Ordnance Department’s munitions production program before and during the war. Prior to the beginning of operation at these and other GOCO facilities there were only two government and two private plants manufacturing smokeless powder and six ordnance manufacturing arsenals. Estimates were that those facilities could provide only about five percent of the munitions that were needed by the Allies (Murphey 1993:3). During operation, IOW #1 produced up to 453,529 kg (nearly one million pounds) of powder each day, and production at HOP went far beyond initial expectations. HOP was one of only a few GOCO facilities to win the Army Navy “E” award, which indicated excellence and efficiency in production, every year of its World War II-era operation.

Soon after the war ended the three plants were consolidated under the new name Indiana Arsenal, and about 2,000 ha (5,000 ac) of the land purchased for IOW #2 was excessed. Parts of the facility were leased to various private manufacturing concerns, and Du Pont made ammonium nitrate-base fertilizers as part of the U. S. program to aid occupied areas (the Marshall Plan). In some respects, Charlestown (Figure 4) returned to a quieter, pre-war existence (Richey, interview 1994). The traffic jams were gone, trailer parks closed, restaurant and store hours could return to normal--only to undergo many of the same boomtown problems once again as the United States became involved in the war in Korea.

The post-war mission of the arsenal was to be ready to go into operation on a substantial scale within 120 days and to store War Department materials. This included about 1,000 pieces of Joint Army Navy Machine Tools (JANMAT), which were also maintained there at the country’s only Machine Tool Surveillance Laboratory. In 1951 and 1952 Goodyear and Du Pont signed new cost-plus-fixed-fee (CPFF) contracts to operate their respective sections of the arsenal to provide munitions for the Korean conflict. Employment and production both peaked in August 1953, when there were 7,691 persons on the payroll. The Korean War

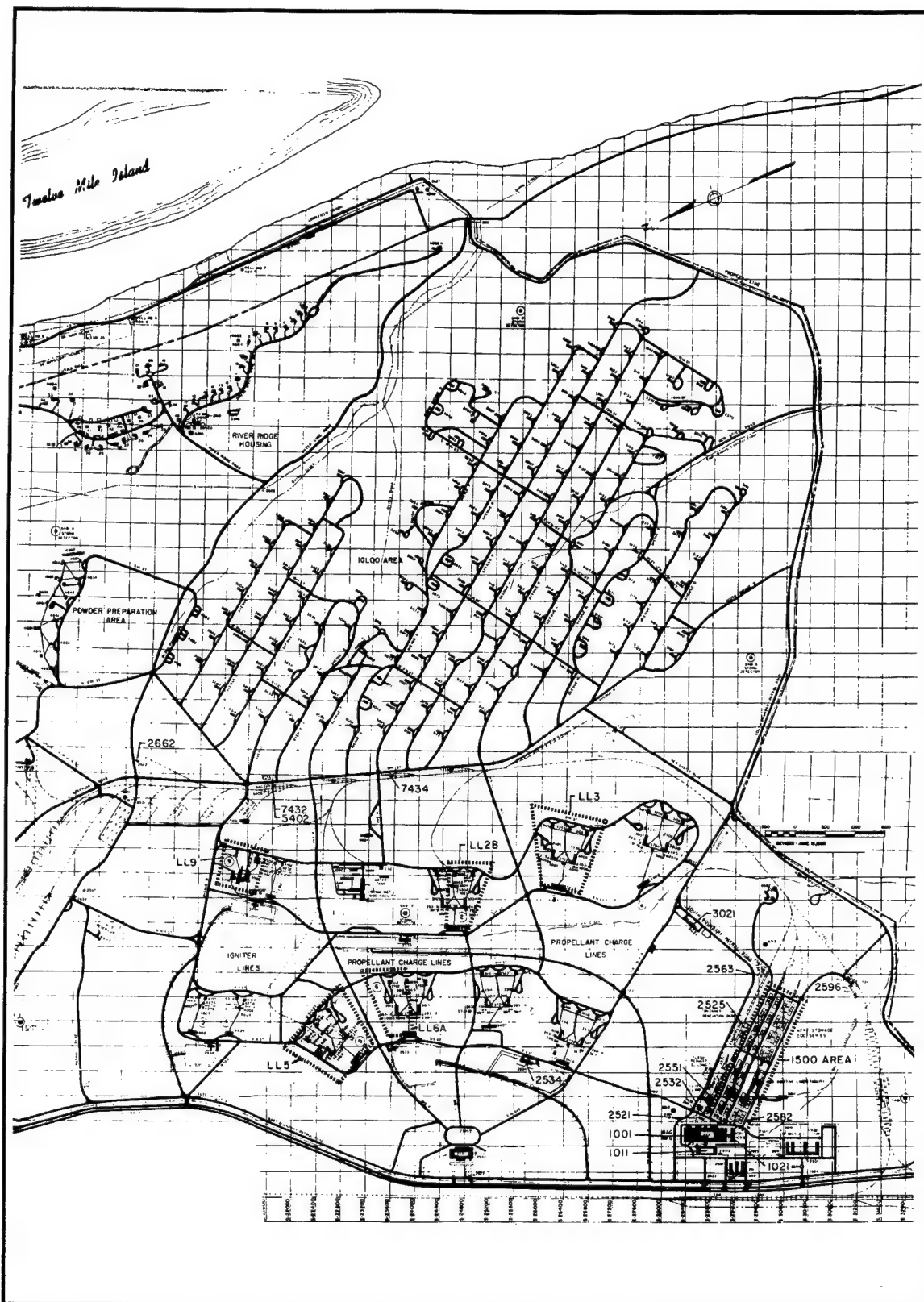


Figure 3. Layout of Hoosier Ordnance Plant (INAAP Drawing 400-900-100).

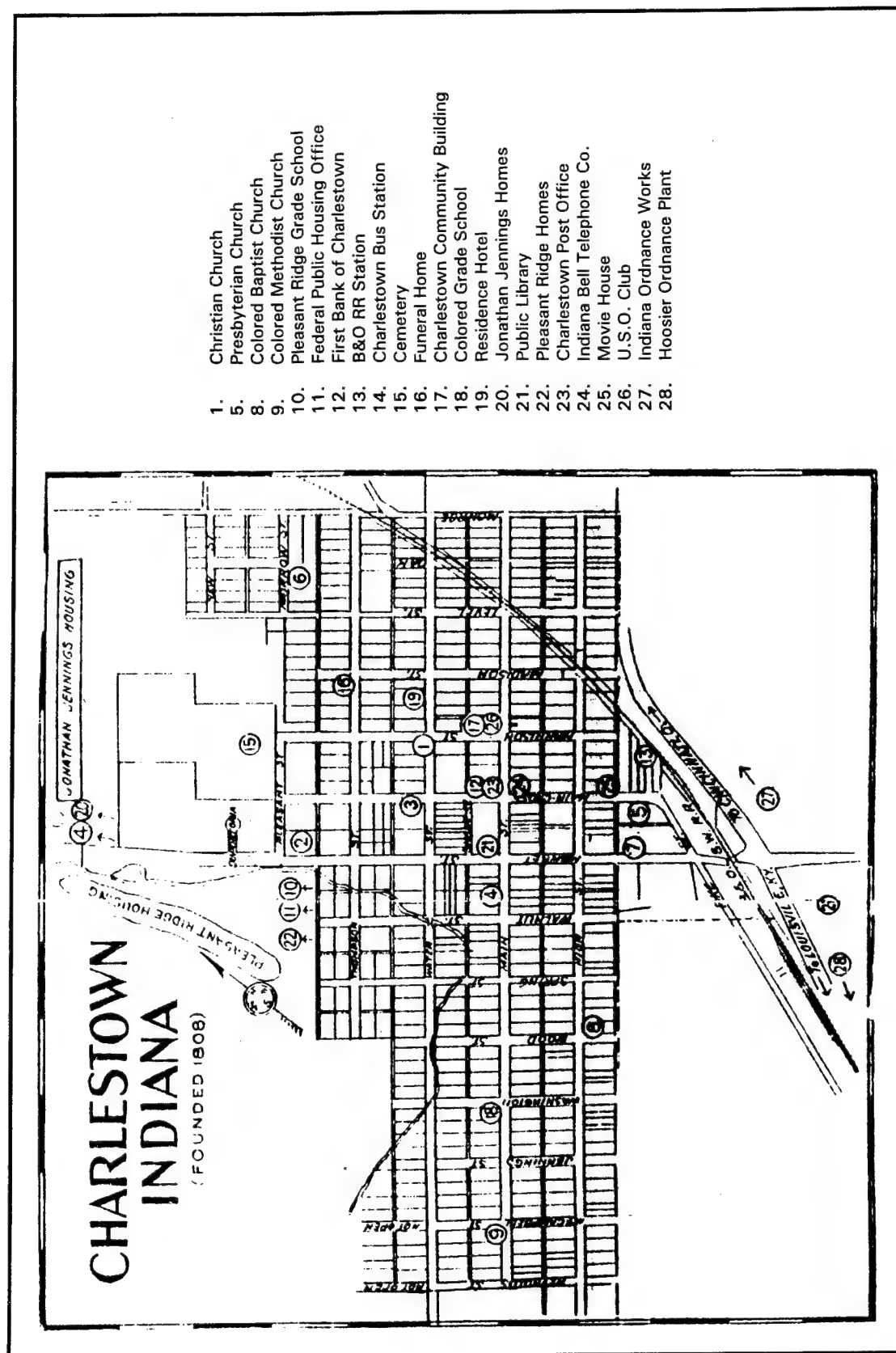


Figure 4. Charlestown, Indiana, ca. 1945 (Anonymous [n.a.] 1945).

ended in January 1953, and in February the second layaway program was initiated. A small amount of powder continued to be produced until September 1957, when the facility was placed on inactive status.

Goodyear became the maintenance contractor for the entire facility in 1959, then handed the responsibility to Liberty Powder Defense Corporation, a subsidiary of Olin Mathieson Chemical Corporation, at the end of the year. At the end of 1961, Liberty was dissolved and Olin assumed all contractual obligations at the Arsenal.

The plant began supplying munitions for the Vietnam conflict in November 1961, the same month it was renamed the Indiana Ordnance Plant. The HOP unit started first, with a slight change over previous missions. In addition to loading new charges, it was also to debag, dry, blend, and cross blend propellant to be reloaded into charges. The IOW #1 unit started operation two months later, directed by the same basic mission under which it had always operated during wartime. In 1963 the plant was redesignated once more, to its present name.

Layoffs due to a decreased need for ammunition began in 1970, and by the end of 1971 employment at the plant had fallen from the 1970 high of 19,000 to 4,500, causing a sharp rise in unemployment in the region. ICI Americas Inc. became the operating contractor in May 1972. In addition to manufacturing three primary products (charge bags, bore wear reducing liners, and finished charges), the mission of the plant called for ICI to renovate used charge storage containers and to maintain the facility in a state of readiness. As the Cold War has drawn to a close, the facility has been deemed unnecessary and is now slated for closure.

THE MILITARY AND POLITICAL SETTING

The Ordnance Works System 1918 to 1940

All agencies involved in the procurement of materiel learned valuable lessons during World War I, lessons which led the U.S. to be much more prepared when it entered World War II. No procurement system was in place prior to the First World War, and as a result War Department officials had little with which to build a procurement strategy. Without an inventory of existing materiel production facilities, unnecessary factories were constructed (Green et al. 1990:24-25). Without personnel in charge of coordination, agencies within the War Department competed against each other for labor and supplies (Hewes 1975:30). At one point during the war "more than 150 War Department purchasing committees were competing with each other for scarce supplies in the open market" (Hewes 1975:28), prompting one observer to describe the effort as "nearly a perfect mess" (Hewes 1975:29). One of the more serious results of the lack of coordination was an imbalance in production, giving the Ordnance Department "more guns than gun carriages, more gun carriages than recuperators, more machined shell bodies than booster assemblies" (Green et al. 1990:25). No attempt was made to rectify the problem until 1918, too late to benefit the war effort (Green et al. 1990:24-25).

Congress ensured that such a procurement experience would not again occur by passing the National Defense Act in 1920. This act reorganized the War Department and mandated that all military procurement be organized through the Assistant Secretary of War to prevent rivalry between the various arms of the military. In order to fulfill his responsibilities under the act, the Assistant Secretary of War established the Planning Branch, Office of the Assistant Secretary of War, which was put in charge of both procurement and industrial mobilization planning (Green et al. 1990:32). In 1922, personnel in the Planning Branch set up the Army and Navy Munitions Board to coordinate Army and Navy procurement (Smith 1959:40-43). These two agencies in conjunction with the Chief of Ordnance and the Manufacturing Service of the Ordnance Department took care of interwar procurement planning for the Army (Green et al. 1990:30-32, 51).

The Ordnance Department was divided into three main sections. The General Office was in charge of administration, the Field Service handled maintenance and materiel distribution, and the Manufacturing Service took care of the design and manufacture of materiel (Green et al. 1990:32-33). The Manufacturing Service was redesignated the Industrial Service in 1938, and it was this section that administered the WWII-era Ordnance Department GOCO Industrial Facilities Program. In 1939 the Industrial Service included Ammunition; Artillery, Aircraft, and Automotive; Small Arms; and Procurement Planning divisions and it managed several field agencies, including Ordnance Districts, Arsenals, Loading Plants, and Acceptance Proving Grounds (Green et al. 1990:84).

The most significant agencies in terms of procurement planning were the Ordnance Districts and the Arsenals. The first, organized during World War I, were established to assist in "mobilizing local civilian industry for war production" (Green et al. 1990:26). Each Ordnance District was administered by a District Office; each office was headed by a civilian District Chief prior to Pearl Harbor, and by Ordnance Department officers thereafter (Campbell 1946:23). By 1940 there were 13 District Offices, in Birmingham, Boston, Chicago, Cincinnati, Cleveland, Detroit, Hartford, New York, Philadelphia, Pittsburgh, Rochester, St. Louis, and San Francisco (Thomson and Mayo 1991:13). The Industrial Service was also in charge of the six "old-line" arsenals of Springfield, Watervliet, Watertown, Rock Island, Frankford, and Picatinny.

The Ordnance Districts were to keep in contact with potential contractors whose facilities could be converted to war production and to maintain records of the materiel manufacturing potential within their districts (Campbell 1946:11, 13, 18-22; Green et al. 1990:55; Thomson and Mayo 1991:13). They also conducted machine tool surveys, and their findings were important to the expediting of machine tool production during the mobilization period (Green et al. 1990:56-57), thus allowing GOCO Industrial Facilities to be up and running sooner than would otherwise have been possible.

Arsenals were responsible for the peacetime preservation of the knowledge necessary to manufacture war materiel (Campbell 1946:11, 35-37; Thomson and Mayo 1991:5). These facilities maintained "not only blueprints of components of weapons, ammunition, and vehicles, but carefully planned shop layouts and details of processing . . . for distribution to new contractors" (Green et al. 1990:7). During the industrial mobilization prior to World War II and during the war itself, personnel at these arsenals trained GOCO facilities contractors in manufacturing, inspection, and research and development procedures (Green et al. 1990:7).

Throughout the interwar era, Ordnance personnel worked with industry experts to plan for future production of propellants, explosives, and associated chemicals. Plans and specifications for "typical plants" were developed based on the "technical developments of Picatinny and Frankford Arsenals" (Thomson and Mayo 1990:11). A planning suboffice was established in 1937 in Wilmington, Delaware, in connection with this work (Campbell 1946:261). Picatinny personnel also worked on plans for "the design and construction" of load, assemble, and pack (LAP) facilities, which proved to be a valuable resource for "the construction, management, and operation" of all GOCO LAP facilities (Campbell 1946:261-262).

The Ordnance Department used data from the District Offices and Arsenals to develop its own procurement plans and to contribute to the procurement and industrial mobilization plans developed by the Army during the interwar years (Green et al. 1990:51, 54-55). Three important assumptions underlay these plans. First, planners assumed that private industry would be called upon to make most war materiel. It was estimated that the six old-line arsenals could produce only four or five percent of the ordnance that would be needed in the event of war (Campbell 1946:5, 101, 397; Green et al. 1990:66; Thomson and Mayo 1991:9). Second, although some private facilities could be converted to wartime ordnance production, planners assumed that new industrial facilities would have to be constructed to produce many kinds of war materiel because there were no private factories in the U.S. manufacturing many of the items of ordnance that would be necessary in the event of war. Third, military planners assumed that the new ordnance manufacturing facilities would be owned by the government. Private industry would not want to finance (and in many cases

could not afford to finance) facilities that would in all likelihood be entirely unprofitable after hostilities were over (Campbell 1946:112; Fine and Remington 1972:114). These three assumptions led planners to envision a GOCO industrial facilities program as a major segment of their overall procurement effort.

Working against this effort for much of the interwar period was the tradition of American isolationism. The desire to avoid entanglement in political affairs and alliances abroad was well established in American culture prior to the Revolutionary War. Although isolationism was doomed to failure in a world constantly shrinking due to advances in technology, it was still a defining element of American thought until at least 1941 (Drummond 1955:1). There was an intense resurgence of isolationism after the First World War, when it spread "wider and deeper through the fabric of American thought than it ever had before in history" (Drummond 1955:21). Many felt the U.S. had been duped into wrongfully entering the war, and isolationists were convinced that steps should be taken to ensure that the country would not become involved in any future European war (Drummond 1955:24-25).

Anti-military and anti-arms producer sentiment also reached a high point after the First World War. There was a movement in Congress to show that "the true causes of America's recent intervention were to be found in the policies which bankers and industrialists had selfishly foisted upon the government during the long months of neutrality" (Drummond 1955:40). The repudiation of arms manufacturers issued by the U.S. Senate Munitions Inquiry, formed in the spring of 1934, is credited with great influence upon 1930s neutrality legislation and with keeping the issue of isolationism constantly at the focus of public debate (Drummond 1955:40-41). In 1936, polls showed that 82 percent of Americans were in favor of prohibiting "the manufacture and sale of munitions for private profit" (Drummond 1955:43).

Military budgets were severely cut during the interwar years, in part for the above reasons (Green et al. 1990:53), which adversely affected the budget of the Ordnance Department. The Depression prompted further reductions. However, by the mid-1930s the growing military strength and increasingly aggressive actions of Germany, Italy, and Japan had escalated tensions and the possibility of international conflict to a degree that military appropriations in the U.S. began to increase. In 1938, which marked a turning point for the Ordnance Department, Congress awarded funding for the purchase of equipment needed for the manufacture of powder and small arms ammunition, and for the operation of LAP facilities (Thomson and Mayo 1991:11-12). That year U.S. firms also began supplying the future American allies, working through a loophole in strict neutrality legislation (Drummond 1955:50) to supply foreign governments with "guns, rifles, ammunition, airplanes, and other military equipment" (Green et al. 1990:66).

Germany invaded Poland on September 1, 1939. Two days later Britain and France declared war on Germany. Within a week President Roosevelt proclaimed a state of limited national emergency (Green et al. 1990:65). In November, with the European conflict steadily escalating, Congress altered neutrality legislation to permit "cash-and-carry" sales of materiel to nations at war.

Hitler's successes in the spring of 1940 prompted further American assistance. Denmark fell in April, and in May the Germans invaded the Netherlands, Belgium, and Luxembourg. By the second week of May they had broken through the Maginot Line and begun their advance toward Paris. According to U.S. law, only surplus materiel could be sold to Britain and France, and it had to be transferred indirectly. So "some five hundred thousand rifles, eighty thousand machine guns, and considerable quantities of field artillery, bombs and ammunition" were declared surplus and sold to U.S. Steel, which had agreed to act as intermediary in the transfer (Drummond 1955:149-150; Green et al. 1990:73). Prompted by the fall of France, President Roosevelt declared a state of unlimited national emergency on May 27, 1940 (Fine and Remington 1972:327).

With Hitler's stunning victories, Congressional opposition to increased defense spending vanished (Green et al. 1990:66-67). The first national defense appropriations act was passed June 26, 1940 (Campbell 1946:12; Thomson and Mayo 1991:44), and the Munitions Program was approved four days later. This

latter program called for the "immediate procurement of equipment for 1,200,000 ground troops, procurement of important long-lead-time items for a ground force of 2,000,000, creation of productive capacity for eventually supplying a much larger force on combat status, and production of 18,000 airplanes" (Thomson and Mayo 1991:12). This paved the way for the appropriation of the first major sum for facilities construction (\$436 million, approved July 1), and for the signing of the first GOCO facility contract, which covered the design, construction, and operation of IOW #1.

Planning for the Installation

On June 25, 1940, Acting Secretary of War Louis A. Johnson set up the War Department Site Committee, with the director of the Planning Branch of the Ordnance Department, Colonel Harry K. Rutherford, as its head. The committee developed basic criteria for choosing sites for the ammunition plants under the general guidelines that they were not to be east of the Appalachian Mountains, west of the Cascade or Sierra Nevada mountains, nor within 200 miles of the Canadian or Mexican borders (Fine and Remington 1972:134-135). Plants engaging in the same type of production were to be scattered so a single attack could not seriously cripple any one aspect of production. Planners were also to avoid highly developed industrial areas and to closely consider the technical, production, and transportation requirements of individual facilities (Fine and Remington 1972:134). The requirement that the plants be located away from highly developed industrial areas was intended to spread economic development further afield and create more jobs in areas that needed them most, but rural locations would heed construction and production. Proximity to main railroad lines and to adequate amounts of suitable labor were considered to be more important by the Site Committee and the early GOCO contractors who were advising them--Du Pont, Hercules Powder Company, Atlas Powder Company, and Trojan Powder Company (Myers 1992:10). Specific requirements for powder plants included easy access to cotton supplies to provide the linters for the production of smokeless powder, and a steady source of the enormous amounts of water needed for powder production (BTI 1984:16).

The importance of a good water supply was a determining factor in many cases. IOW #1 was built alongside the Ohio River, Radford Ordnance Works was located on the New River, and Alabama Ordnance Works on the Coosa River. This had an indirect effect on the location of LAP facilities, since it was more efficient to place these near a source of the primary component they were loading. The pairing of IOW #1 and HOP is one of several examples of this strategy (cf. Elwood Ordnance Plant and Kankakee Ordnance Works, Lone Star Ordnance Plant and Longhorn Ordnance Works, Radford Ordnance Works and New River Ordnance Plant). Another important consideration was the availability of land. Buildings were to be widely spaced to ensure that an explosion at one point would not damage other buildings and cripple the entire facility. Tracts quite large relative to the combined floor space of the buildings were needed. IOW #1 and HOP covered a combined total of nearly 4,050 ha (10,000 ac) upon completion of the initial phases of construction, fully three-fourths of which was devoted just to the storage of explosives.

The Charlestown site was attractive in part because the town was set back away from the river, leaving the area alongside the Ohio sparsely populated. The acquisition of a large area would displace relatively few people. Also, with the exception of a few tracts, the agricultural usefulness of the land in the area was on the decline, making the land less valuable to owners. And Charlestown itself was certainly not highly developed industrially. Nearby Louisville, Kentucky, on the other hand, was developed. There were only two problems with the site at Charlestown, neither of which seems to have been noticed until after the decision to use the area was already made. The first was the subsurface rock, which made excavation for piping difficult. The second was a marsh that lay where the bag manufacturing area was planned. Neither proved to be a great difficulty.

It should also be noted that Indiana, Illinois, and Ohio each had six GOCO facilities, more than any other state save Texas, and that the plants in the three together accounted for nearly 23 percent of all GOCO facilities. No reason for this concentration of so many plants in the three-state region has been found. One

possible advantage to locating in Indiana was offered by an ex-governor of the state, M. Clifford Townsend, who said the state had been so fortunate because of "peaceful relations between labor and industry" (Armstrong 1941:n.p.). The same may have been true of Illinois and Ohio.

The Dual Nature of the CPFF Contract

CPFF contracts were widely used for both the construction and operation of GOCO facilities during World War II--and widely criticized, due in part to their similarity to contracts used during World War I. Contracting practices during that war led to accusations of favoritism, waste of tax dollars and corruption (Fine and Remington 1972:26-27), attributed in part to the widespread use of cost-plus (CP) contracts, which reimbursed contractors for costs and paid them a percentage of those costs as profit. This type of contract encouraged contractors to pad expenditures as a means of increasing the fees they were paid, and thus, their profits. For this reason the CP contract was abandoned in 1918, when the floating fee was replaced with a fee of a fixed amount determined at the time the contract was let (Fine and Remington 1972:23). This was an improvement, but the earlier problems had strongly stigmatized cost-plus contracting in general, particularly in the minds of politicians (Fine and Remington 1972:389).

Still, cost-plus contracts were viewed as a necessary means of industrial mobilization, especially by the military, and most of the contracts between the Ordnance Department and the operators of World War II-era GOCO facilities were CPFF in nature. Levin Campbell believed the CPFF contract to have been "a major contribution to the success of the nation's war production program" (Campbell 1946:108). Perhaps the most important aspect of the CPFF contract was that it bypassed the lengthy process involved in competitive bidding, the standard method of awarding government contracts during peacetime (Patterson 1941:336; Thomson and Mayo 1991:110), a great advantage in a war mobilization effort that needed to be accomplished in 12 to 18 months (Fine and Remington 1972:574). It also offered flexibility in undertaking a job for which no accurate means of determining overall costs existed (Polenberg 1972:12; Thomson and Mayo 1991:16). The CPFF contract assured the contractor of a profit, necessary if they were to be drawn away from civilian markets that appeared much more lucrative and worth investing in compared to capital intensive military production of products that offered no promise of a long term market. And it eliminated the disincentive to perform cost effective work inherent in the earlier CP-type contracts. In the words of Secretary of War Henry L. Stimson, "if you are going to try to go to war, or prepare for war, in a capitalist country, you have got to let business make money out of the process or business won't work" (Polenberg 1972:12).

Detractors of the CPFF contract, on the other hand, believed this type of contract was not the best way to "let business make money out of the process" because it too often allowed exorbitant profits to be made. By 1944, fees paid to operators had been reduced three times, and some said they were still excessive (Thomson and Mayo 1991:113, 130). Contracts for construction and architect-engineer work spawned the more heated debates concerning excessive fees, most notably during well-publicized hearings held during the 1940s, when the Truman Committee conducted its investigation into defense construction contracting. The committee found that the earnings of the 25 architect-engineer firms they investigated were on average 30 percent higher than they had been during peacetime (Fine and Remington 1972:423). And investigations like that of the House Military Affairs Committee, which looked into the cost of construction of the Louisiana Ordnance Plant, found construction fees were also excessive (Campbell 1946:109).

Several methods were developed by the government to combat unreasonably high earnings. An excess profits tax was approved in October 1940 and the first Renegotiation Act was approved in April 1942. Six months later an amendment to the act made all contracts worth more than \$100,000 open to renegotiation. After this legislation was passed contracting agencies had three new and powerful means of combating excessive profits--they could make the contractor return a portion of the profits to the government, cut the fees stipulated in the contract, or deduct the amount determined to be excessive from future reimbursements. This method of "recapture" affected construction subcontractors supplying equipment at the Hoosier Ordnance

Plant, just one example of how the government tried to mitigate the less desirable aspects of CPFF contracting.

The Indiana Ordnance Works--GOCO's World War II Beginning

IOW #1 and HOP were in nearly all aspects of design, construction, and World War II-era operation entirely separate. For purposes of greater clarity, this discussion will follow each plant from its beginning through the end of the war separately, discussing the INAAP facility as a whole only after it became a single entity in 1945.

Architectural and Engineering Design

In June 1940, when the first defense construction funds became available,² a dispute "between the Quartermaster Corps and the Ordnance Division as to who should have supervision over the building of plants" arose, the impetus of the conflict being Charlestown's IOW #1 (Fine and Remington 1972:185). The Chief of Ordnance, Major General Charles M. Wesson, had negotiated "an agreement with E. I. Du Pont de Nemours & Company for the design, construction, and operation of the plant" without consulting Brigadier General Charles D. Hartman, who headed the newly created Construction Advisory Committee (Fine and Remington 1972:186). This was in direct contradiction to the Defense Act of 1920, which took construction away from the Construction Division of the Army and handed it over to the Quartermaster Corps (Fine and Remington 1972:38-39). Ordnance officers favored a construction arrangement in which the agency that would run the plants would also design and build them (Fine and Remington:186). Ordnance officer Colonel James H. Burns tried to resolve the difference in positions by outlining a procedure under which the branch of the service using the facility would name firms to operate the plants and act as "management agents" during construction while Hartman would choose building contractors "in consultation with and subject to the concurrence of the interested service" (Fine and Remington 1972:186).

Assistant Secretary of War Louis A. Johnson approved the procedure on July 11, 1940, but six days later Wesson defied compliance by signing an agreement with Du Pont covering the design, construction, and operation of the Indiana plant (United States Government CPFF Contract No. W-ORD-458). By the end of July, however, Wesson agreed to follow the procedure outlined by Burns, and so IOW #1 became the only World War II-era munitions project for which a single contractor was solely responsible for all aspects of construction and operation of a plant.

The Du Pont Company

As a young man, Éleuthère Irénée du Pont de Nemours studied under the chemist in charge of manufacturing gunpowder for the French government. He emigrated to the United States at the end of the eighteenth century, entering into a partnership for the production of gunpowder and explosives in 1802. The first Du Pont factory went up on the banks of the Brandywine River in Delaware and quickly earned a reputation for producing superior gunpowder.

² "Funds for the financing of this Project, Contract W-ORD-458, and Supplements 1, 2, and 3 thereto, Job P-5-6932-41-1, also known as Contractor's Project No. 5979, were originally allotted by the Quartermaster General and the Chief of Ordnance. Funds allotted by the Quartermaster General were later transferred to the Chief of Engineers when war construction work became the responsibility of the Corps of Engineers, on December 16, 1941" (IOW [1942]b:57).

When E. I. du Pont died in 1834 his sons Alfred and Henry bought out the French financiers and expanded production to include smokeless powder, dynamite, and nitroglycerine. Cousins Thomas Coleman and Pierre S. du Pont had bought into the company by the turn of the nineteenth century, and when they first incorporated in 1902, Du Pont controlled 36 percent of the U.S. powder market; three years later the share had increased to 75 percent. Such a huge endeavor made new methods of corporate organization necessary, which Du Pont found in the work of managers Amory Haskell and Hamilton Barksdale. Their reorganization "revolutionized American business and gave birth to the modern corporation" (Derdak 1988:328). Du Pont was so successful that it was able to absorb all domestic competition, which prompted the U.S. government to initiate antitrust proceedings, ordering the corporation to divest itself of much of its business holdings in 1912.

Du Pont was involved in U.S. government munitions production during World War I, building and operating a smokeless powder plant at Hopewell, Virginia. That facility was producing more than a million and a half pounds of nitrocellulose a day by the end of the war. Following armistice, the plant was burned.

After World War I, the company decided synthetic fibers were more profitable than gunpowder. Du Pont began to diversify, initiating production of cellophane and Rayon in the 1920s, then creating Nylon in 1930. Nylon captured a great deal of public attention throughout that decade, and it was speculation about a plant to produce this modern fiber that spawned excitement in Charlestown in 1940.

The main reasons Ordnance chose Du Pont to build and operate its first post-World War I ammunition plant were three-fold. First, and probably the most persuasive for Ordnance, was that Du Pont had operated a powder production facility in Virginia during the previous world war. Second, Du Pont's business was the production of just the product Ordnance wanted manufactured. Most companies involved in World War II munitions manufacturing were chosen in part because they had experience in the organization of mass production efforts; thus, such seemingly unlikely candidates as Proctor and Gamble and the Coca-Cola Company were selected. But Du Pont's expertise did not stop there. The company had experience in mass production techniques and organization; this experience lay specifically in the area of gunpowder manufacture; and it had done similar work for the government before. These three portions of Du Pont's resume made the company one of the most preferred choices to build the pilot plant for Ordnance's World War II GOCO endeavor.

Plant Design--Under the Wire

During World War I, 17 plants had been built for the manufacture of powder and explosives. None of these had been intended to be lasting facilities, and at the end of the war they were all dismantled, or, in the case of the one Du Pont had built, burned (Myers 1992:9). Ordnance tried to alter this strategy as it prepared for the next round of munitions facility construction. IOW #1 was the first plant funded, and it was to be a permanent installation. Frank A. Rager, a journalist who reported on the construction in progress noted that

the construction is all of a permanent type, concrete, steel and brick. Engineers will tell you that not one of the 608 buildings will need repairs within the next 25 years (Rager 1941b:n.p.).

IOW #1 got in just under the wire, though, since this idea of permanence in construction was short-lived. Lieutenant General Levin H. Campbell (Chief of Ordnance, 1942-1946) even declared that in the planning of some of the first wave facilities there had been "a leaning toward grandeur" (Fine and Remington 1972:316). Such expenditures were abandoned within a matter of weeks, as will be seen in the discussion of HOP. Even the use of brick for exterior walls was forbidden unless absolutely necessary.

All plans for IOW #1 were prepared by Du Pont's Design Division in Wilmington, Delaware. A Chief of Ordnance representative, Major General Charles T. Harris, was at that office by July 25, 1940, the day the

design work began, to approve all drawings for manufacturing buildings and processes (IOW [1941]:July 23, 1940). Approval of the design of non-manufacturing buildings and utilities would initially come from Harris as well, later from Corps of Engineers representatives at their suboffice in Wilmington. Only two minor plans were furnished by the Quartermaster General--the standard loading platform for making soil bearing tests and the concrete monuments for marking property boundaries (IOW [1942]b:45).

The cost of materials specified in the design seems to have been of secondary importance at that time. An entry concerning purchases in the plant diary notes that Ordnance "will be lenient on defense projects" (IOW [1941]:August 10, 1940). Brick was used in nearly all the main buildings, including the Administration Building (Figure 5), the cafeterias (Figure 6), the change houses, and the fire houses (Figure 7). Other architectural accents which would later be called unnecessary frills included the entrances and windows, where cast concrete and limestone provided linear accents (Figures 8, 9 and 10). The administration area, which included the Administration Building (Building 703), Telephone Exchange (Building 702), Hospital (Building 719-1), Repair Shop (Building 716-3), Cafeteria (Building 708-1), Guard Headquarters (Building 720), and Office Building (Building 703-1C), was "obviously intended to be the plant's most 'public' architectural statement" (BTI 1984:18 and 61). The focal point of the area is the Administration Building, similar in style to simplified, late-WPA architecture (BTI 1984:61).

The plant was divided into eight areas by function:³

100 Area--Nitrocellulose Production	500 Area--Utilities
200 Area--Powder Production	600 Area--Miscellaneous Services
300 Area--Acid Production	700 Area--Administration
400 Area--Power	900 Area--Organics

The placement of these buildings was governed primarily by safety quantity distances, which specified how far a building had to be separated from other structures to minimize damage in the event of an explosion.

There are two aspects of the design of IOW #1 that may be considered flaws. The first is its size. To operate efficiently, the plant must produce its products in quantities so large that demand is sufficiently high only during wartime (Hackel, interview 1994). There is little choice but to let the plant go idle at other times. The second is that the plant was designed to produce only single-base propellant. Although there was still great demand for single-base powder after World War II, double-base smokeless powder, or rocket propellant, was being used more and more in artillery since it was more powerful. The technology to produce double-base powder was available at the time the plant was designed, and it was likely Du Pont could foresee this as the powder of the future. However, since production of double-base powder requires the use of nitroglycerine, safety quantity distances are much greater. This means the production capabilities at IOW #1 could not be later upgraded because the buildings were too close. This may be one reason Radford Army Ammunition Plant, a more "temporary" facility that one ICI employee described as "in the dark ages" compared to IOW #1, but which can produce double-base powder, is still in operation while INAAP is slated for closure. IOW #2 would have added double-base powder production capabilities, but the war ended before it could be completed and subsequently all equipment was dismantled.

Ranney Wells

Smokeless powder production is notorious for the amount of water required, and, as mentioned above, an abundant source of water was one of the primary considerations used to determine acceptable locations for

³ Each building at IOW #1 originally had a three-digit number, the first digit designating the area the building belonged to, and, therefore, its general function.

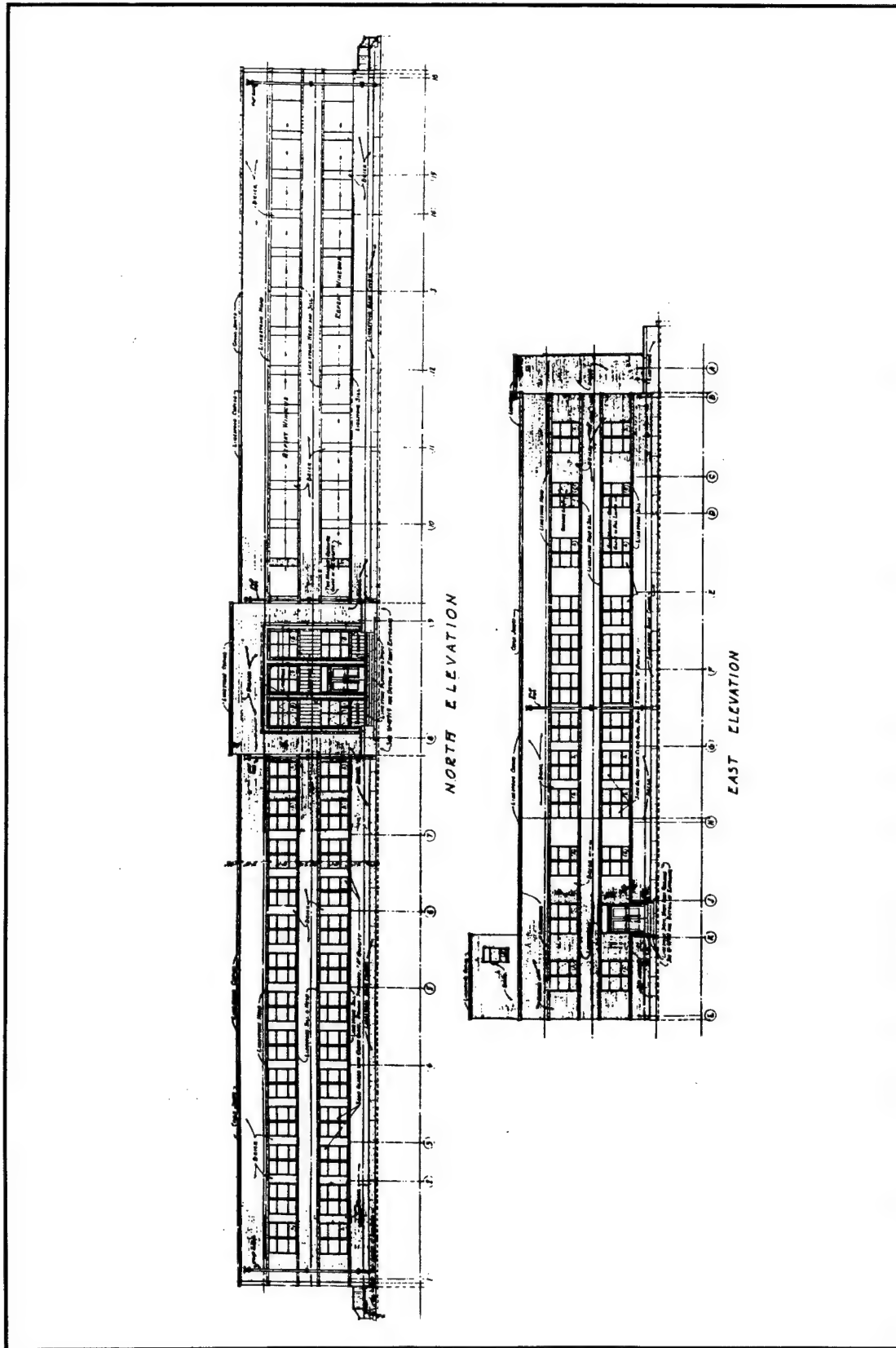


Figure 5. Elevations, Administration Building (Building 703), Indiana Ordnance Works Plant 1 (INAAP Drawing W-45916).

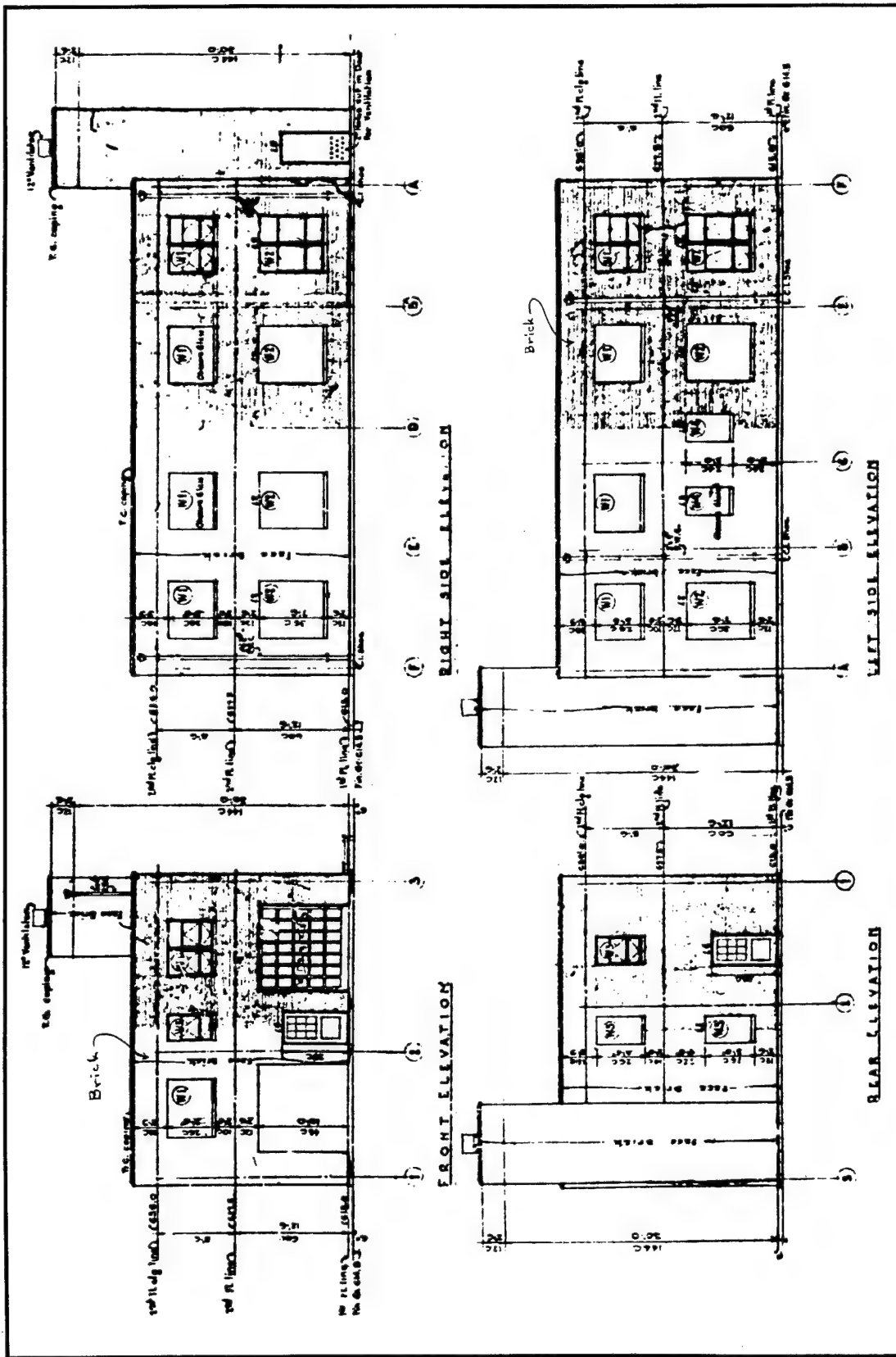
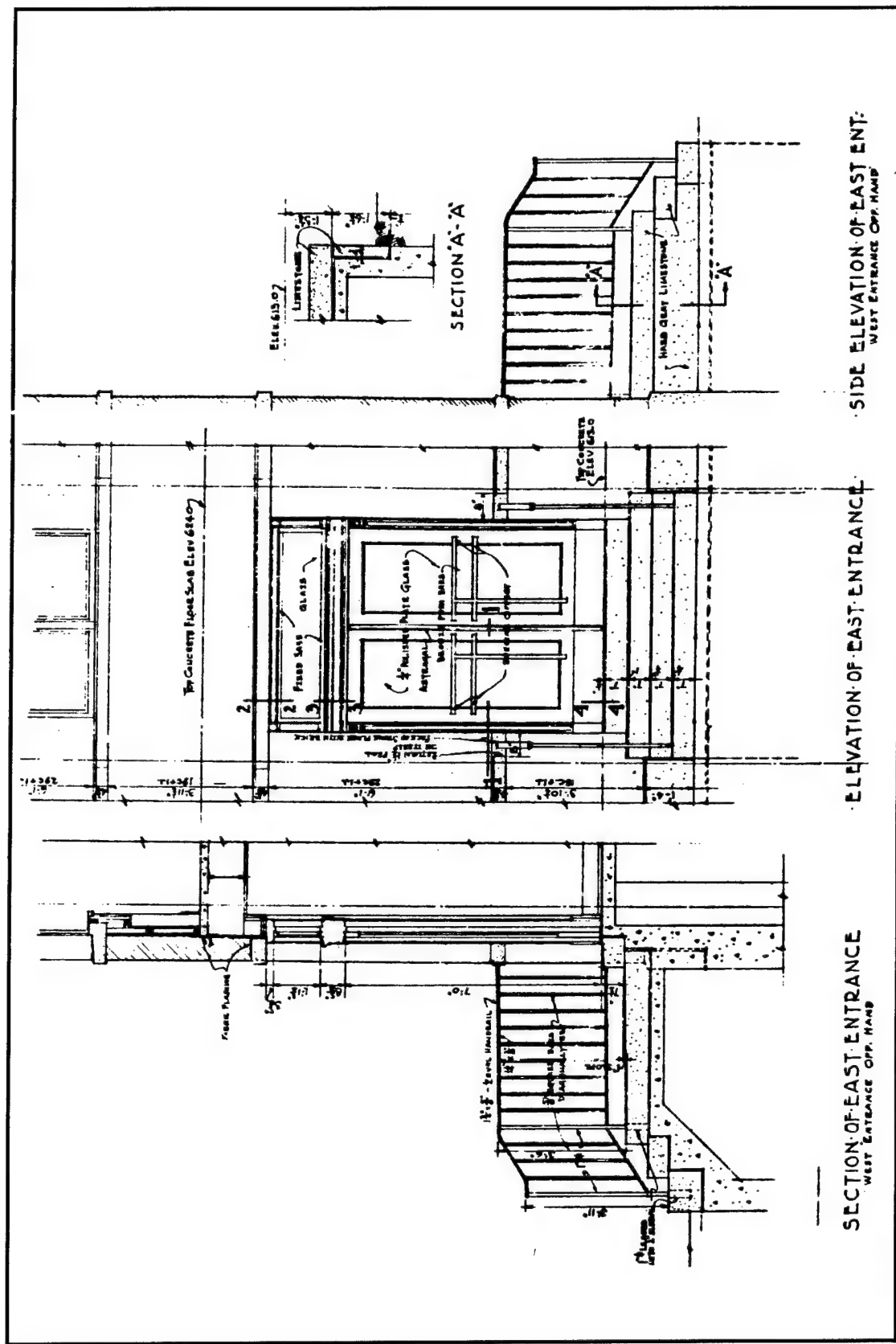
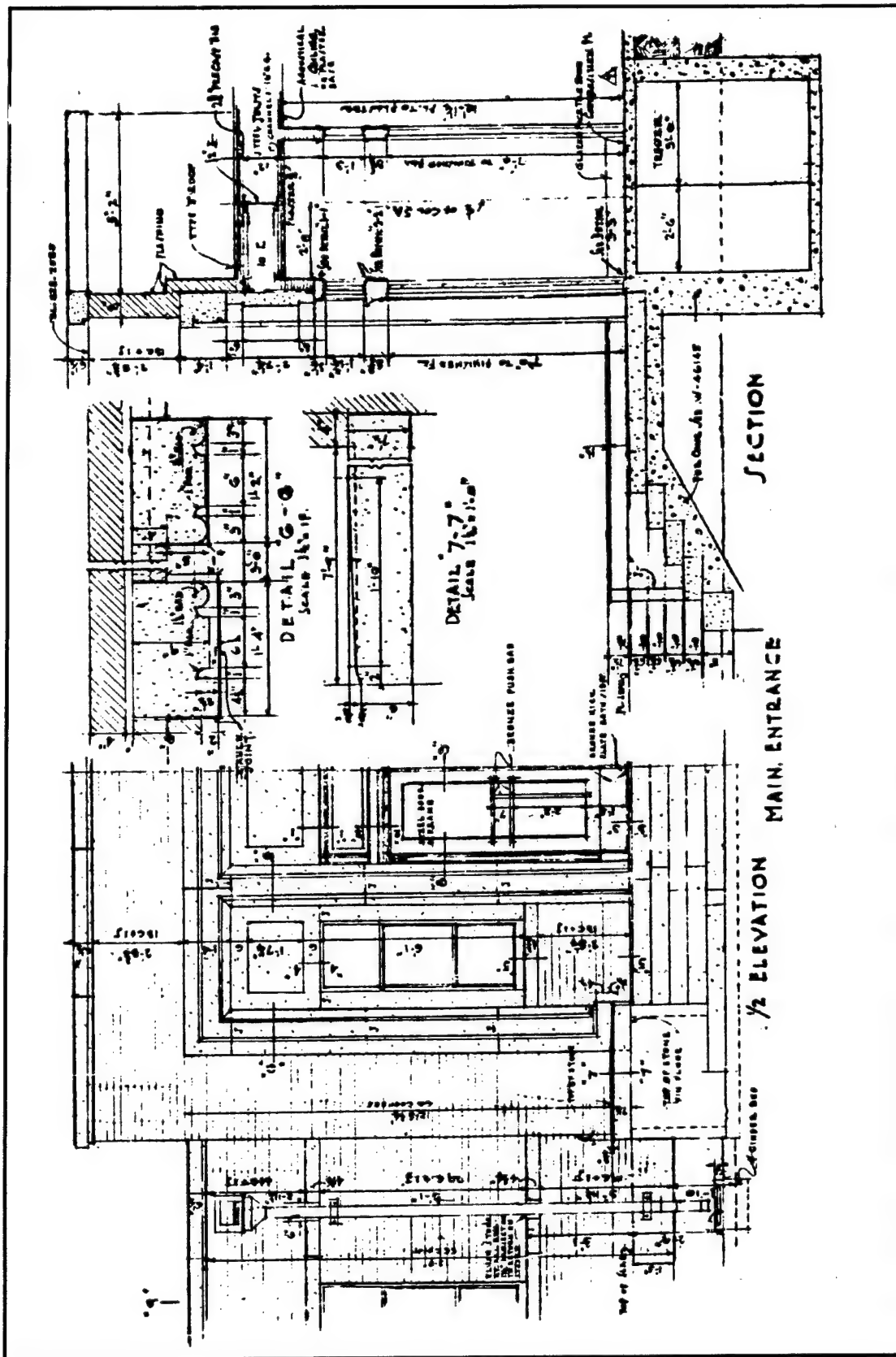


Figure 7. Elevations, Fire Headquarters (Building 709-A), Indiana Ordnance Works Plant 1 (INAAP Drawing W-45944).





powder plants. Du Pont looked to a then state-of-the-art system for collecting water at IOW #1--the radial well. The system the company installed has a capacity of 265 million liters (70 million gallons) per day and is still the largest well water system ever set up in the United States (Murphey 1993:7).

In the early stages of planning and design it was Ordnance rather than Du Pont that was in charge of the water system. In a September 1940 letter from A. G. Sperl (War Department, Office of the Quartermaster General), the preliminary testing for installing a water system for the plant was discussed. Four test wells had been drilled in high ground near the Ohio River to a depth of about 9 m (30 ft) in search of suitable water-bearing gravel beds, with none producing satisfactory results. Sperl suggested drilling up to 30 m (100 ft) deep in search of a source known to exist 15 to 21 m (50 to 70 ft) below the surface in neighboring localities. He also suggested using water directly from the Ohio River (IOW [1941]:copy of letter attached to September 3, 1940 entry). This implies that a conventional well system was at that time being considered. However, there was another choice.

The Ranney Water Collector Corporation of New York had designed the first radial well not long before the construction of IOW #1 was authorized. The design employed technology developed by the Canadian-born founder of the company, Leo Ranney, and was a "radical departure from the orthodox type of well construction" (Maratta 1938:26). The radial collector was actually an old idea that had never been widely used because a method of pushing the radials into the surrounding strata without compressing the soil ahead of and around the pipe, reducing permeability and increasing siltation, had never been developed (Nebolsin 1936:576). Ranney solved the problem by attaching a special digging tip to the radials that would remove "fine material in its path . . . to develop a graded filtering medium surrounding the screen surface of the collector pipes" (Maratta 1938:26).

Ranney wells consist of a concrete caisson approximately 4 m (13 ft) in diameter that extends to the bottom of the water-bearing formation. In the bottom section are ports through which are pushed the 20-cm (8-inch) laterals. The laterals, which can be up to 273 m (250 yds) long, are slotted almost their entire length to allow water to enter, giving these wells much greater contact with the water-bearing strata than a conventional vertical well (Anonymous n.d.a:15-24).

The biggest disadvantage of the Ranney Collector system is initial cost. In general, one Ranney Collector needs to produce at least 11,000 and preferably 19,000 liters (3,000 to 5,000 gallons) per minute in order to be cost effective. If the demand for water is this high there are several reasons Ranney wells are preferable to standard vertical wells.

1. The long 20-cm laterals give the collector a huge contact area with the water-bearing material, so the velocity of water flowing through the slots is very low, "a few hundredths of a foot per second or less." Engineers try to keep entrance velocity below 3 cm (.1 ft) per second on any well; radial wells far exceed this. For the user, the significance of low entrance velocity is less clogging--"in fact, there is indication that this type well is not subject to loss in capacity due to clogging."
2. The system can effectively draw a large amount of water from a relatively thin strata of water-bearing material.
3. It takes fewer Ranney wells than conventional wells to supply the same amount of water, so large multi-well systems will require less piping and subsurface work and fewer connections (Anonymous n.d.a:15-24).

The War Department was unlikely to have known much, if anything, about radial wells. Prior to 1940 there were only four Ranney systems operating in the United States. But Du Pont's engineers were familiar with the innovative technology--they had just installed Ranney systems at three New Jersey plants which impressed them enough that they suggested the government invite Ranney to submit a bid for installing a system at IOW #1 (BTI 1984:58). Ranney may have been uncertain about some aspect of the work, perhaps the ambitious size of the project, as they included a clause in the first contract drawn up allowing them to "withdraw from

the contract at any time without any obligation to Du Pont or the Government” (IOW [1941]:October 7, 1940). Understandably, Ordnance refused to give its approval to this document. The following day the government learned that clause could be eliminated, so they agreed to the contract (IOW [1941]:October 8, 1940).

The initial contract called for the first two wells to be constructed simultaneously. In November 1940 it was decided that a faster pace “was of vital importance in order to have construction well along before spring floods may cause serious damage and delay in the operation of the plant.” The contract was modified to allow four wells to be installed simultaneously (IOW [1941]:November 12, 1940). In all, seven wells were installed. At the end of 1940, the completion dates of the first five were estimated at February 15, February 18, the first week of March, the third week of March, and the first of April. All were to be completed by the first of May (IOW [1941]:December 2, 1940).

Each well house contains two pumps with a combined capacity of 185,485 liters (49,000 gallons) per minute, giving the system a total daily capacity of 267.1 million liters (70.56 million gallons), “a supply more than sufficient to serve the entire needs of a city the size of Louisville, Kentucky.” The water is stored in two 19 million-liter (five million-gallon) reservoirs, one at each power house, and one overhead tank for drinking water (IOW [1942]b:50).

The seven wells are all located on the west bank of the Ohio River. Each well (Figure 11) has a concrete caisson 4 m (13 ft) in diameter which extends down into a water-bearing sand and gravel bed, between 23 and 27 m (75 and 89 ft) below the surface. The bottom of all caissons are sealed by a cement floor. Each well has seven to thirteen radials set at two to three elevations extending 6.7 to 83 m (22 to 273 ft) from the caisson (Figure 12). The average collector pipe per well is 389 m (1,276 ft), and each well can pump up to 26,498 liters (7,000 gallons) per minute. This capacity can be upgraded to about 37,854 liters (10,000 gallons) per minute (Farris 1944:1-2), but such an upgrade has not previously been necessary—even when production was at its peak during World War II, pumpage was well below the rated capacity of the system (see Figure 12).

The Construction Phase--The “First Wave” Rises in Indiana

The first man on the IOW #1 construction site was Lieutenant Colonel Kelly H. Lewis, who would oversee operations throughout most of World War II. The officer was at the plant site beginning July 27, 1940, to oversee the arrival of construction materials. At that time, he was working under Colonel Rosswell E. Hardy, plant commander, until February 11, 1942, when Lewis assumed that position. Figure 13 shows the landscape before construction began on the facility that would dominate life in the area for the next several decades.

As news reports and rumors spread information and misinformation about when construction would begin, thousands of jobless men jammed the employment offices Du Pont opened in the area. Within the space of one month all skilled construction laborers within a radius of 80 km (50 mi) of Charlestown had been hired and the contractor began hiring from other parts of the country. Ed Howard hired on at this time, working first as a millwright and, still during construction, as the mechanical engineer for the 100 Area. “Mechanics came from all over the United States. . . . And they were the best mechanics. . . . You got the finest mechanics in the United States to build that plant because there was nothing else going” (Howard, interview 1994).

This was of course still during the Depression, when for many people any paying job was a blessing. Construction work at the plant not only paid, but rumor had it that it paid well. For the prime contractor, wages were to follow local practice and, where applicable, union guidelines. Du Pont could set wages

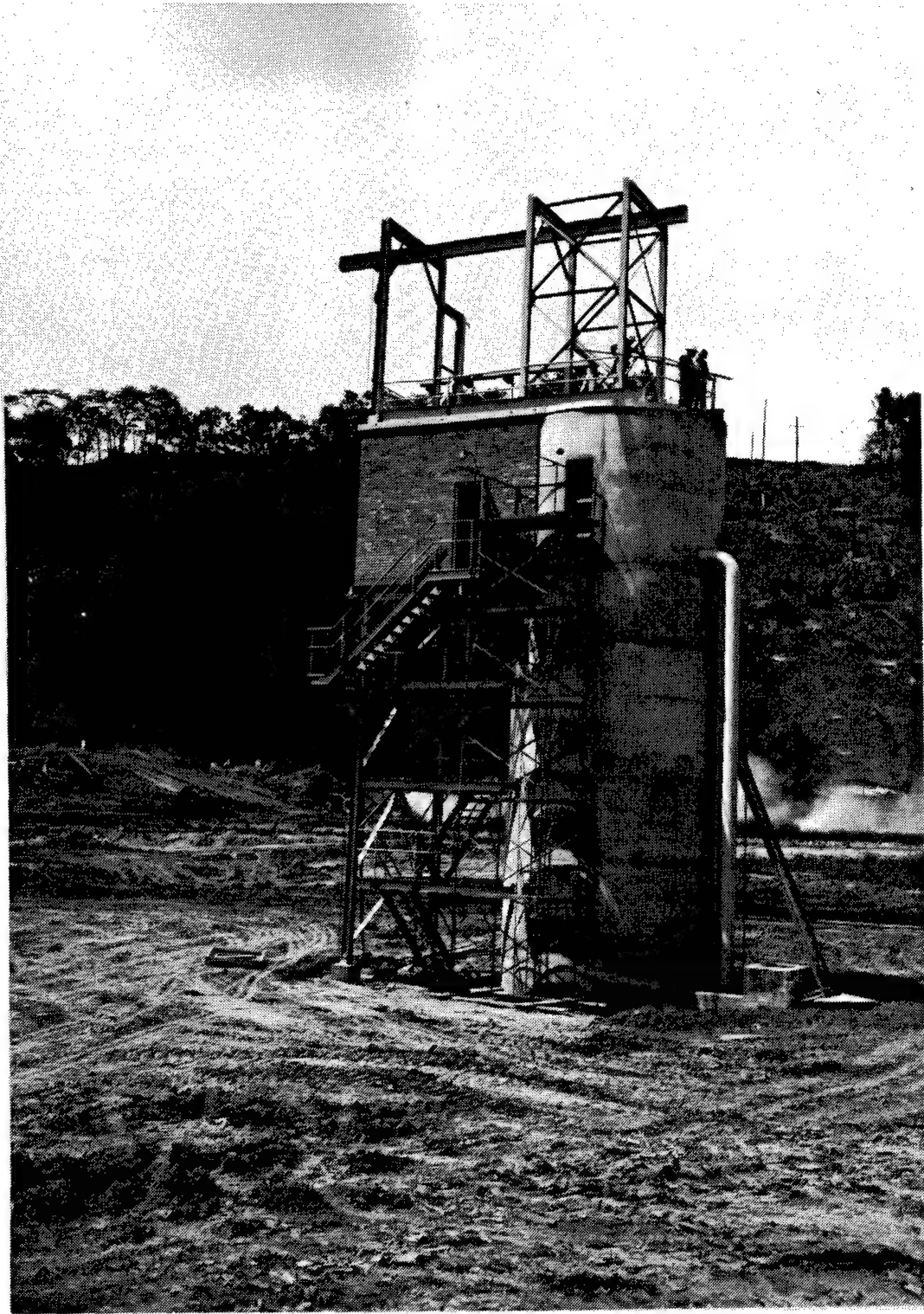
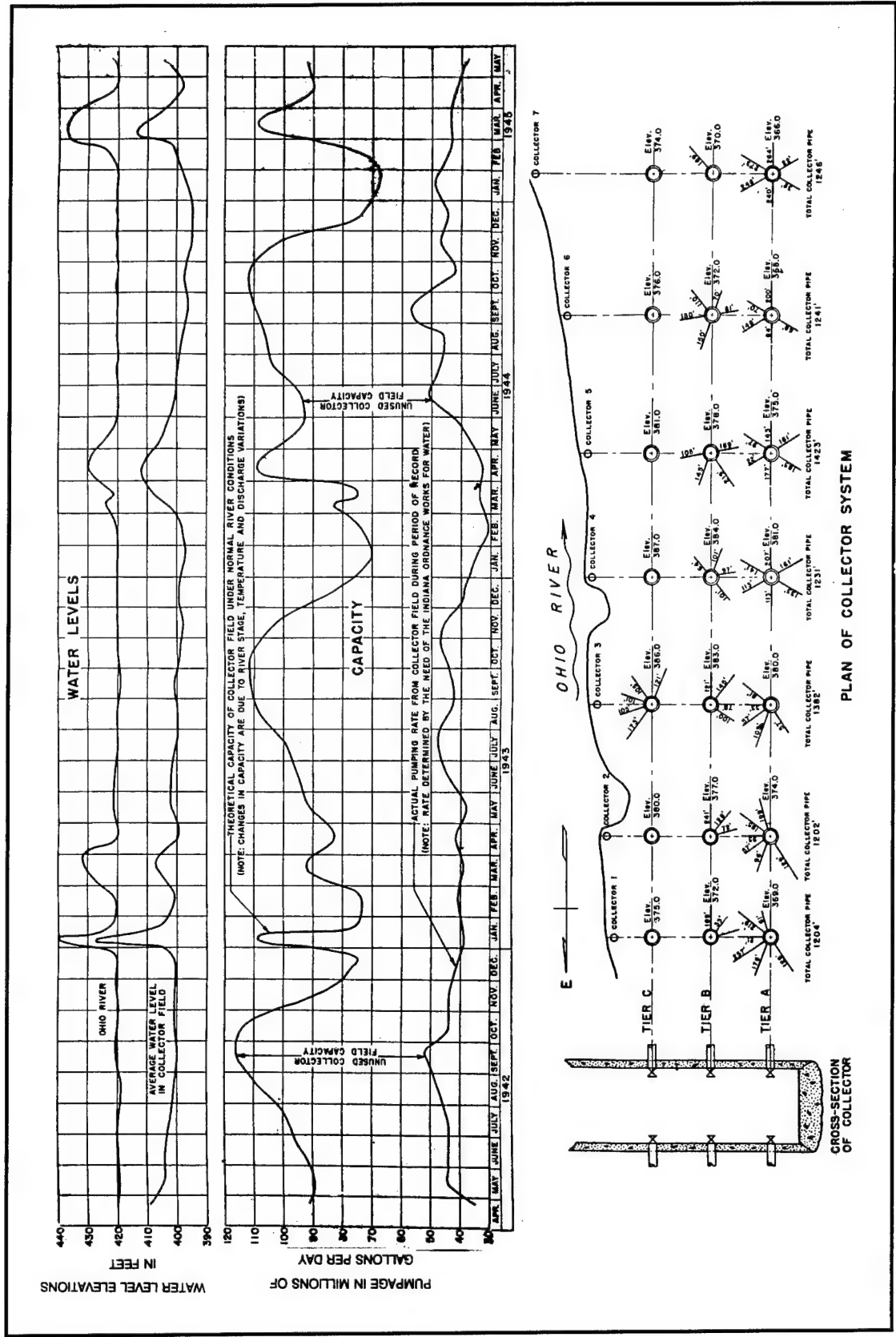


Figure 11. Ranney Well Number 2 under construction (photo courtesy INAAP).



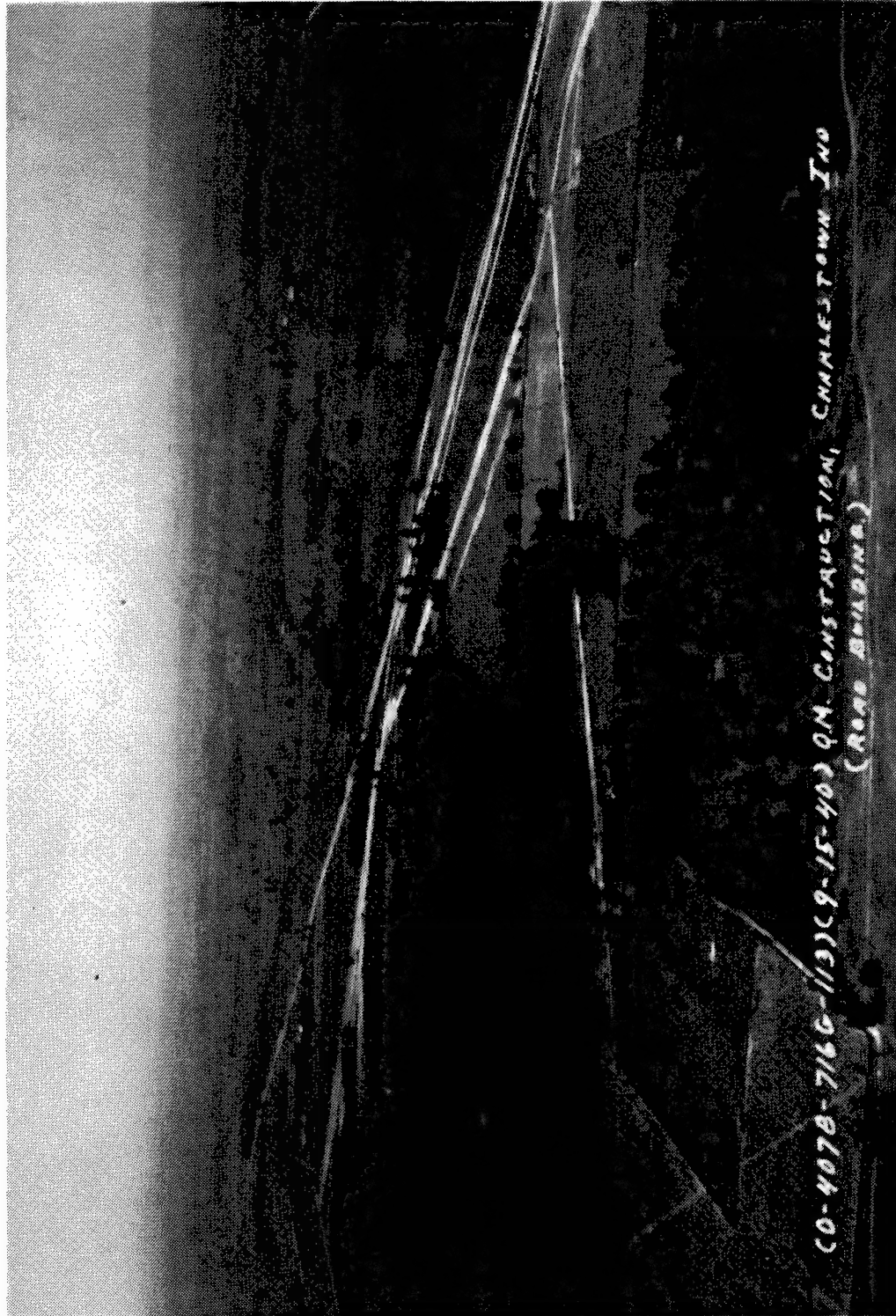


Figure 13. The INAAP area prior to construction (photo courtesy INAAP).

subject to the approval of the Department of Labor, and by most accounts these were above minimum standards. There was less supervision of subcontractors, and some were criticized for failing to follow prevailing rates. One example was a plumbing company that was paying its plumbers \$1.25 an hour (the going rate in Kentucky) when the usual rate in Indiana was \$1.50 (IOW [1942]a:September 13, 1940). Unskilled laborers drew less than half this amount, 60 cents an hour, yet there was no shortage of applicants. Carpenters were paid a prime rate of \$1.30 an hour and were still in short supply. Some or all employees may have also received a transportation supplement of 50 to 64 cents per day (Howard, interview 1994; IOW [1941]:September 14, 1940).

Construction officially commenced August 26, 1940, but actual building at the site did not get underway until September 4. In only four days of work 141 cu m (60,000 board ft) of lumber were on the ground. By the end of September, temporary offices, carpenter shops, tool sheds, time-clock alleys, and 8 km (5 mi) of railroad track within the complex were 95 percent complete (Rager 1941a:n.p.). And by 1941 many of the steel skeletons of the major buildings were in place (Figure 14).

A second shift went to work the second week of October, and a third was added by the end of the month. This was done not only to speed construction but also to keep overtime costs to a minimum and to give employment to as many applicants as possible. The three shifts and the number of workers on each shift allowed construction to proceed at an unprecedented rate (Figure 15).

It was one of the few times that I ever saw the side wall of a three-story building that you could stand back and actually watch it grow. . . . They had brick-layers shoulder to shoulder [working on the nitrating buildings in the 100 Area], . . . they'd draw their line across, and those guys would just start in and just do bricks just like that, and you could literally watch that line . . . go up.

People to a degree were running over each other, but you can understand, everything was timing and material, and nobody in the government didn't ask you if you could, the government said you'll do this, we'll pay you this extra money, so there was money wasted, there's no doubt about it, but you cannot force graft an operation of that magnitude without having some loss at the time. It was really an excellently . . . orchestrated and operated group. . . . The Du Pont company [came] in here with their expertise [and] did one of the most outstanding jobs of construction that was ever done in the United States (Howard, interview 1994).

The construction labor force was apparently primarily union. There were no work stoppages, and the record indicates Du Pont was very willing to work with the local chapters. Membership did keep some from employment, however. One example involved non-union bricklayers in the Louisville vicinity, 200 of which signed a petition in December 1940 that stated that they wanted to work at the site but objected to paying the \$107.00 fee to join the union.

Employment reached its zenith on May 1, 1941 (Figure 16). On that day there were 27,520 persons on contractor, subcontractor, and government payrolls. (It should be noted that this figure does not include the approximately 5,000 employees by now at work just down the road at HOP, nor Du Pont employees not involved in construction, nor Ordnance employees.) Of this total, 18,884 were employed by the prime contractor, 8,270 by the various subcontractors, and 336 were civilian Quartermaster Corps employees (INAAP [1963]:10).

By this time organization must have been a very unwieldy beast. According to an Administration and Maintenance Inspector, "a great many of the workmen on the buildings are not giving an honest days [*sic*] work. At different times groups of men have been seen visiting, and at times some of the men have no business in the buildings they are visiting in. Another thing, lots of the foremen of crews spend a lot of their time away from their men" (IOW [1942]c:May 6, 1941). According to Ed Howard, one way the contractors kept people from standing around was by having them carry a two-by-four around the perimeter road. When



Figure 14. By January 1941, the steel skeletons for the power plant and a nitrating building in the 100 area were almost complete (photo courtesy INAAP).



Figure 15. Bricklayers at work on one of the power plants at Indiana Ordnance Works Plant 1 (photo courtesy INAAP).

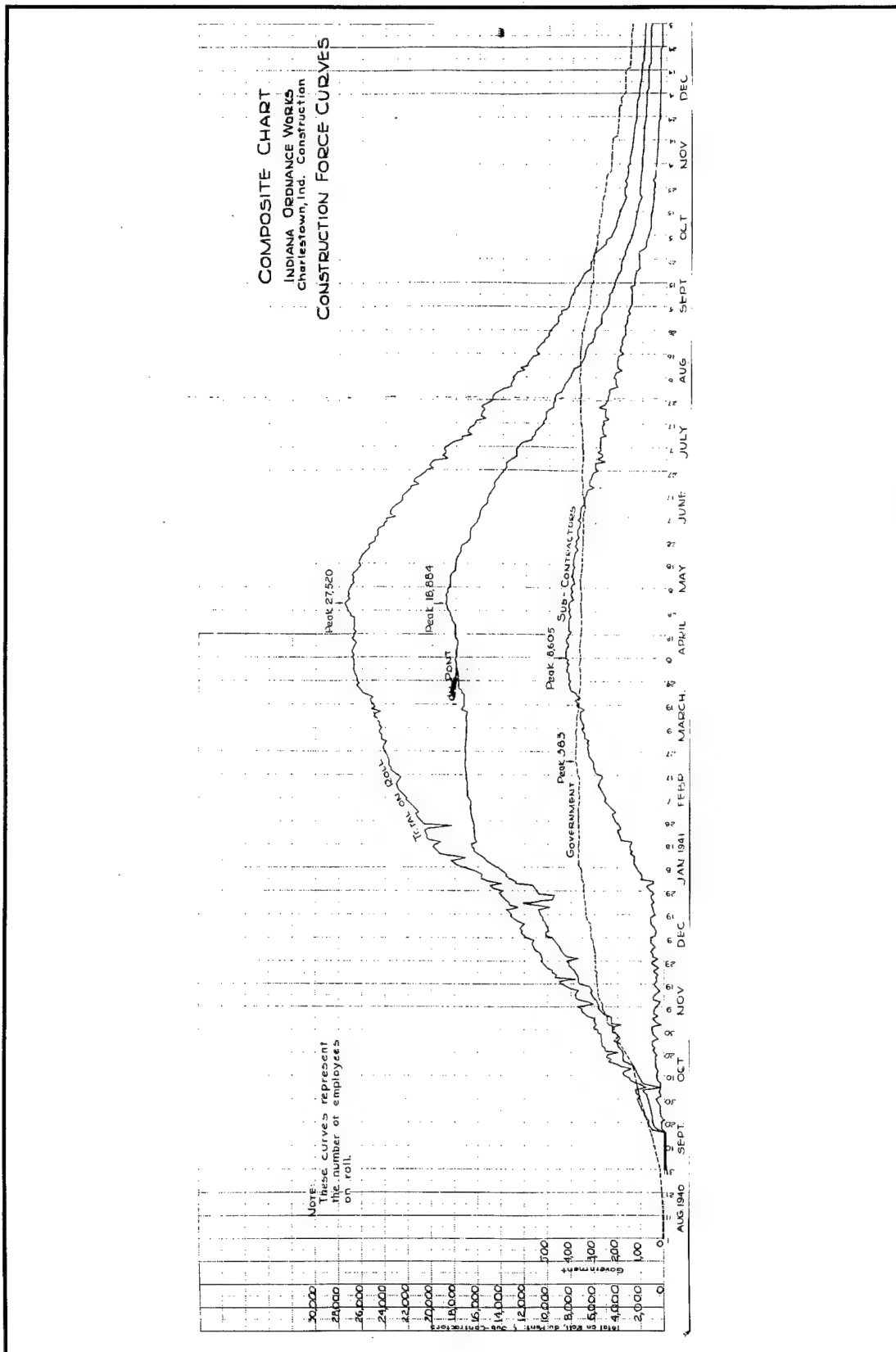


Figure 16. Construction era employment force chart for Indiana Ordnance Works Plant 1 (IOW [1942]b).

someone needed laborers, a taxi truck (flatbed trucks with a running board as a step and two benches mounted back to back lengthwise down the center; these were also used to carry workers from the clock alleys to the work sites at the beginning of their shift and back at the end) would be sent to the perimeter road to collect these people. "They'd just throw the two-by-four off to the side and get on." The rationale was that if these people had not been doing anything, they would have been huddled somewhere talking among themselves and would be more likely to become disgruntled. Therefore, they were sent off with a board for no reason--"they were doing absolutely nothing"--other than to keep themselves busy and in the open where they could be found if needed. "It was smart, a nice way to handle human beings" (Howard, interview 1994).

Howard added that every kind of person worked there, every nationality--"you had mean ones, and you had timid ones and you had dirty ones and you had clean ones. . . ." This included "a lot" of African-Americans and people of Mexican, German and Italian descent--"I imagine you would have found every nationality, but your predominant was black and white" (Howard, interview 1994). It may be that Howard was more observant than others who worked there, but other interviewees reported the work force to have been almost all Anglo-American. Christine Richey worked for Ordnance at the time. "During World War II I don't remember them having very many black people out there during actual construction." Most were white, she said, and in the office they were all white (Richey, interview 1994).

In addition to a massive number of employees, a job of this magnitude required hundreds of pieces of equipment. Du Pont had entered into a subcontract with the Forcum-James Company of Dyersburg, Tennessee, under which Forcum-James was to provide the construction equipment, including 419 pieces of heavy equipment valued at just over a million dollars. These were rented by the hour, and the cost was to include operator, fuel, and maintenance. Rental of this equipment was "the greatest single source of unfavorable comment on the part of the Government inspection forces, as it seemed to be a difficult matter to obtain maximum work per hour of equipment employed" (IOW [1942]b:36.). The fees paid to rent this equipment sometimes amounted to more than the purchase price (it is not stated whether these fees amounted to more than the combined purchase price and costs of operation and maintenance). On October 10, 1940, an investigation was ordered concerning the amounts paid to Forcum-James. "Some of these items are assuming much larger proportions than at first contemplated and it may be some items of equipment could be purchased at less cost than what was being obligated under the rental agreement" (IOW [1941]:October 10, 1940). Because of such problems, a recapture clause was required on latter contracts for equipment rental, and more items were simply purchased. An additional 280 pieces of equipment, valued at almost three hundred thousand dollars, were rented under this modified agreement, and Du Pont purchased 502 pieces for the government, valued at over six hundred thousand dollars (IOW [1942]b:36). Du Pont also employed 78 additional subcontractors to undertake specialized work at the site, using three different types of contracts (lump sum, unit price, and fixed fee) to award the work.

Additionally, an enormous amount of material was needed for construction, the procurement of which had to be well orchestrated to ensure steady progress at the site. Over 30,000 purchase orders were issued by Du Pont, and the company's handling of this aspect of construction was applauded by Ordnance as an "outstanding achievement" (IOW [1942]b:37).

Construction progressed steadily throughout the nine months it took to build the greatest part of the plant, running generally ahead of schedule. "The plant as originally planned was complete and ready for operation seven weeks before the scheduled date." The work specified in Contract W-ORD-458 and the first three supplements added to that contract was completed on May 31, 1942 (INAAP [1963]:9). At that time there were 619 permanent and approximately 100 temporary buildings (used mainly by construction engineers) at IOW #1 (Figure 17). The cost had come to \$107,500,000, about 400 percent over the original budget (Garner 1992:32). However, that original contract had called for only two powder lines. Changes in the scope of work called for upgrading first to four, then to six lines, and the addition of lines that would process dimethylaniline (DMA) and diphenylamine (DPA). The addition of such structures and the equipment they



Figure 17. View of the 100 Area of Indiana Ordnance Works Plant 1 shortly after completion (photo courtesy INAAP)

housed added greatly to the expense. The combined estimates for the original contract and Supplements 1, 2, and 3 came to \$73,370,000 (IOW n.d.:Exhibit A-1), making the project 146 percent rather than 400 percent over budget, as was implied by the media and other reports from that time. The added expense could be attributed to a lack of experience in building a plant of this size. Critics of CPFF contracts contend this method of awarding work also did little to encourage cost effectiveness.

The first smokeless powder was produced at IOW #1 on April 11, 1941, 23 days ahead of schedule. That evening the superintendent of operations said he wanted to start up the 200 area. "If we can do that we'll have done it in nine months." They could not go through the whole process yet, but they were able to take powder that had been nitrated elsewhere, plasticize it, run it through the blocking presses and the extruding presses, and start cutting it (Howard, interview 1994). They were capable of full operation by that May, when the first lot, Number 5500, came off the line. IOW #1 began operating second only to the plant at Radford, Virginia, which had been in production just a couple of weeks (INAAP [1963]:10).

The Operations Era

The most important function, and the World War II mission, of IOW #1 was the production of nitrocellulose (smokeless powder) and black powder for distribution to LAP facilities. Black powder was the more volatile of the two. It was used to set off the smokeless powder--it in effect fired the gun--and the part of the charge it filled was called the igniter. Since it was more volatile, the distances between buildings where this was handled had to be greater. At LAP facilities like HOP, the smokeless powder was placed into bags called "increments," then stacked and fixed together into "charges," the unit which was actually placed in the gun (Hugh 1949:537). The LAP process is discussed in greater detail in the section dealing with operations at HOP. IOW #1 also produced diphenylamine, dimethylaniline, barium nitrate, weak nitric acid, concentrated nitric acid, sulfuric acid, ethyl ether, and aniline, all of which are chemicals used in the production of smokeless and black powder (IOW [1942]b:60).

However, the manufacture of smokeless powder accounted for the bulk of production. The powder sent the projectile through space and provided the power when the projectile contacted the target. Cellulose was first nitrated (mixed with nitric acid) in the 1830s, but its importance as an explosive was not discovered until 1846, when C. F. Schonbein first used a nitric-sulfuric acid to create nitrocellulose. This early form of powder was difficult to control, and "fires and explosions destroyed a number of plants because proper methods of stabilization were unknown" (Greer n.d.:Preface). Scientists at England's Royal Gunpowder Factory added several refining steps to the manufacturing process in 1865, but they still were not able to solve the problem of controlling the burn rate. That problem was not solved until 19 years later, when the propellant evolved into its basic World War II-era shape due to the work of a French engineer who "made the first smokeless powder in which nitrocellulose was gelatinized by ether and alcohol and then produced as small squares, a form which permitted control of its rate of burning" (Greer n.d.:Preface).

At IOW #1, the process began in Building 101 (or rather, one of the six buildings numbered 101; only the first three digits of the building designation, which indicates the building's type or purpose, will be used in this description), where the cotton linters and wood pulp were stored (Figure 18). From there, the cotton went to Building 104 where it was picked, dried and weighed; wood pulp went to Building 122 where it was dried, then shredded and weighed. These products were put into cans, weighed again, and sent by conveyor to the Nitrating House, Building 105. Here the cotton and wood pulp were "nitrated" with mixed acids⁴ to

⁴ These acids were oleum, spent nitrating acid, and an acid mixture called "F-83." Each 140,000-pound batch of spent nitrating acid was tested at the laboratory to determine the correct amounts of oleum and F-83 to be added.

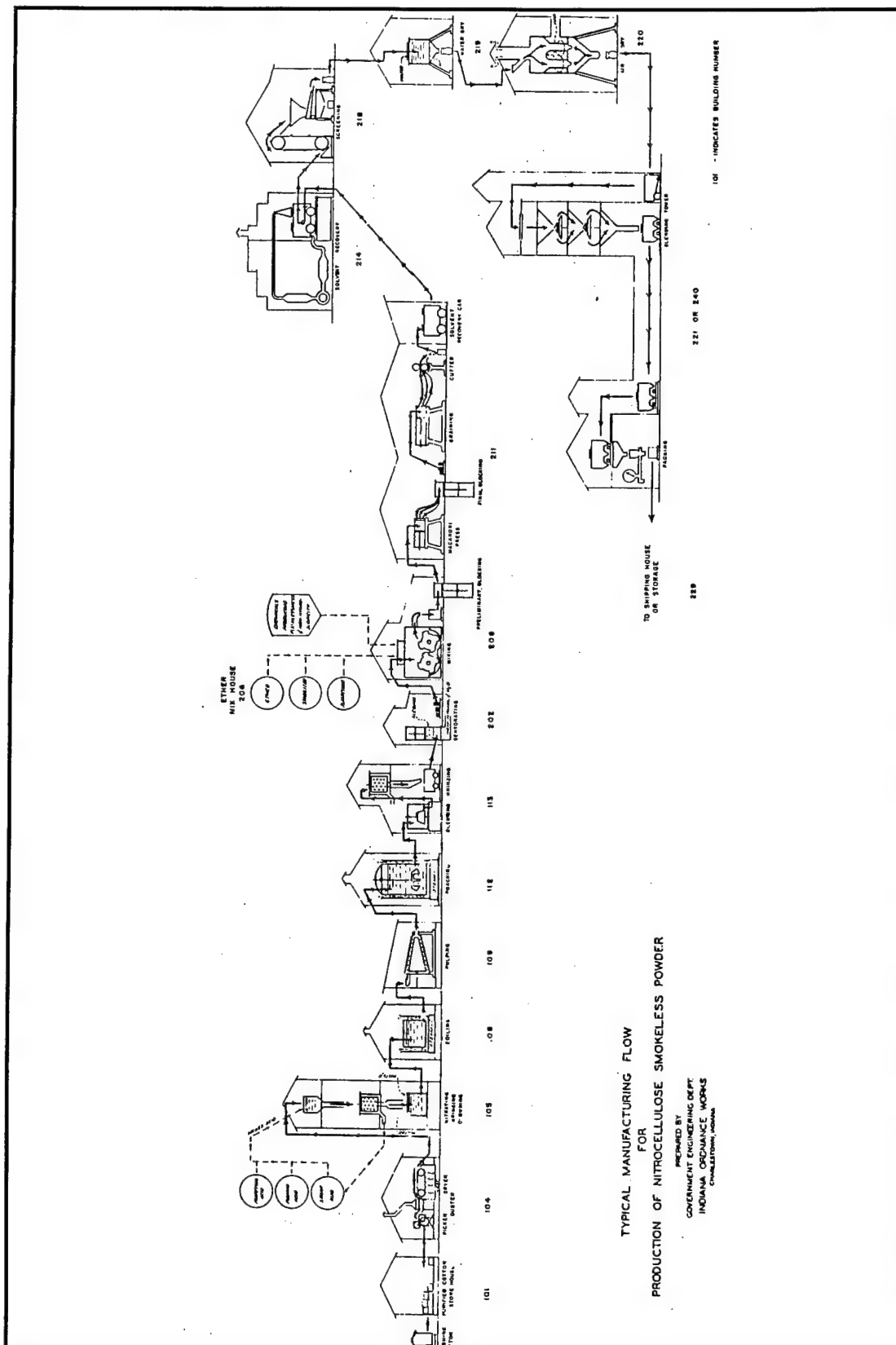


Figure 18. Axonometric diagram showing the manufacturing process for nitrocellulose.

form either “pyro” or “high grade” nitrocellulose⁵ (Figure 19). The cotton linters first went into dipping pots where they were combined with the acid mixture. After mixing for the prescribed amount of time the pots were dumped into wringers to sling off spent acid. The nitrocellulose, which was left, was then immersed in water and pumped to the Boiling Tub House, Building 108. Here impurities in the nitrocellulose were removed by boiling for 40 to 70 hours. The next stop was the Pulping House, Building 109, where the nitrocellulose was cut into smaller pieces. It was then sent to the Poacher House, Building 112, to be once again mixed with water, this time with soda ash added to make it slightly acid. Afterwards, it was washed with fresh water and passed through a “packer screen” to remove oversized and foreign material. Pyro and high grade were combined in a ratio to give the blend a 13.15 percent nitrogen content in Building 113, then this blend was once again put into wringers that dried the nitrocellulose as much as possible. Still damp, it was dumped into small railroad cars and pushed by hand out of the 100 Area and into Building 201 in the 200 Area, where tests determined the moisture content of each batch.

The first step in the 200 Area took place in Building 202, the Dehydration Press House. Here either a Loomis Press or a Baldwin-Southwark Press was used to simultaneously compact and add denatured ethyl alcohol to the nitrocellulose, dispelling the remaining moisture and compacting the nitrocellulose into blocks. The larger blocks, which come from the Loomis Press (Figure 20), weighed about 32 kg (69.5 lbs) each. These blocks then went to the Mix House, Building 208, where dinitrotoluene (DNT), ether, DPA, dibutylphthalate (DBP), and other ingredients were added. This was then macerated and formed into blocks of about 30 cm (1 ft) in diameter and twice as long, which were transferred to Building 211, the Horizontal Press House (Figure 21). Here the blocks were pushed through a macaroni press to again screen out foreign materials, then formed into blocks, and finally extruded through dies. The extrusion process shaped the nitrocellulose into strands that were cut to lengths determined by the type of charge they were to fill. Warm air was used to evaporate most of the remaining alcohol and ether in Building 214 and the powder was again screened for defective pieces and foreign material in Building 218. The powder went through a final washing in Building 219, then it was dried in Building 220 and sent to a blending tower. Because of slight differences in each batch of powder that was manufactured, several batches were mixed in the blending towers to make one uniform lot of about 68,038 kg (150,000 lbs). Each lot was then packaged, the containers checked to ensure they were airtight and sent either to an igloo for storage or to a shipping house for distribution. (This process description was derived from two primary sources--Greer n.d.:1-101; INAAP 1973:II-2-D-15).

Four of the six lines producing smokeless powder were devoted to the manufacture of multi-perforated cannon powder. This powder type could employ both cotton linters and wood pulp as the nitrocellulose base. The remaining two lines were used for the manufacture of single perforated cannon powder and rifle powder, for which cotton linters were needed for the nitrocellulose base. The production processes followed standard military guidelines except in the Nitrating House, where mechanical dippers were used, a Du Pont modification (IOW [1942]b:60-61).

Production increased rapidly and fairly steadily after the first batch came off the line (Figure 22). A and B lines were the first to be started, with production leveling off at about rated capacity when they were brought up to full operation. Production increased when E and F lines went into operation in July 1941. The entire nitrocellulose area was put into production in early October, when lines C and D were completed and produced their first batches of powder. On September 7, 1942, production reached its peak--that day 453,529 kg (almost one million pounds) of powder were run off in one day. The wide variations in the early portion of the graph shown in Figure 22 are due to the way measurements were taken. It should also be noted that during February and March of 1942, when all six lines were operating at approximately their full

⁵ Pyro at INAAP had a nitrogen content of 12.5 to 12.7 percent, and high grade, also known as guncotton, had a nitrogen content of 13.35 to 13.45 percent. “A blend of the two will make a better colloid than nitrocellulose made from a straight reaction” (Greer n.d.:Preface).

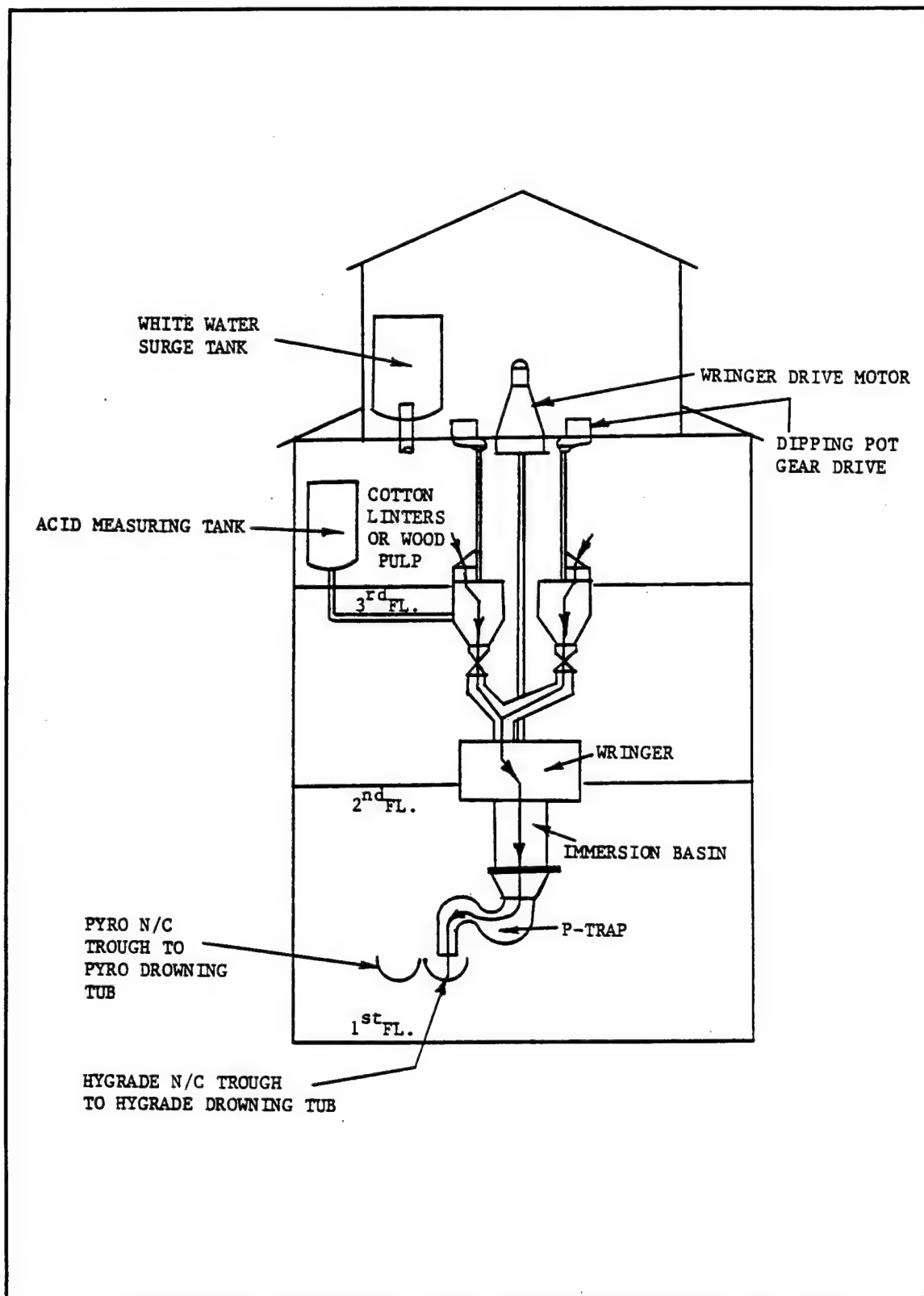


Figure 19. Equipment layout, Nitrating House (Building 103), Indiana Ordnance Works Plant 1 (Greer n.d.).

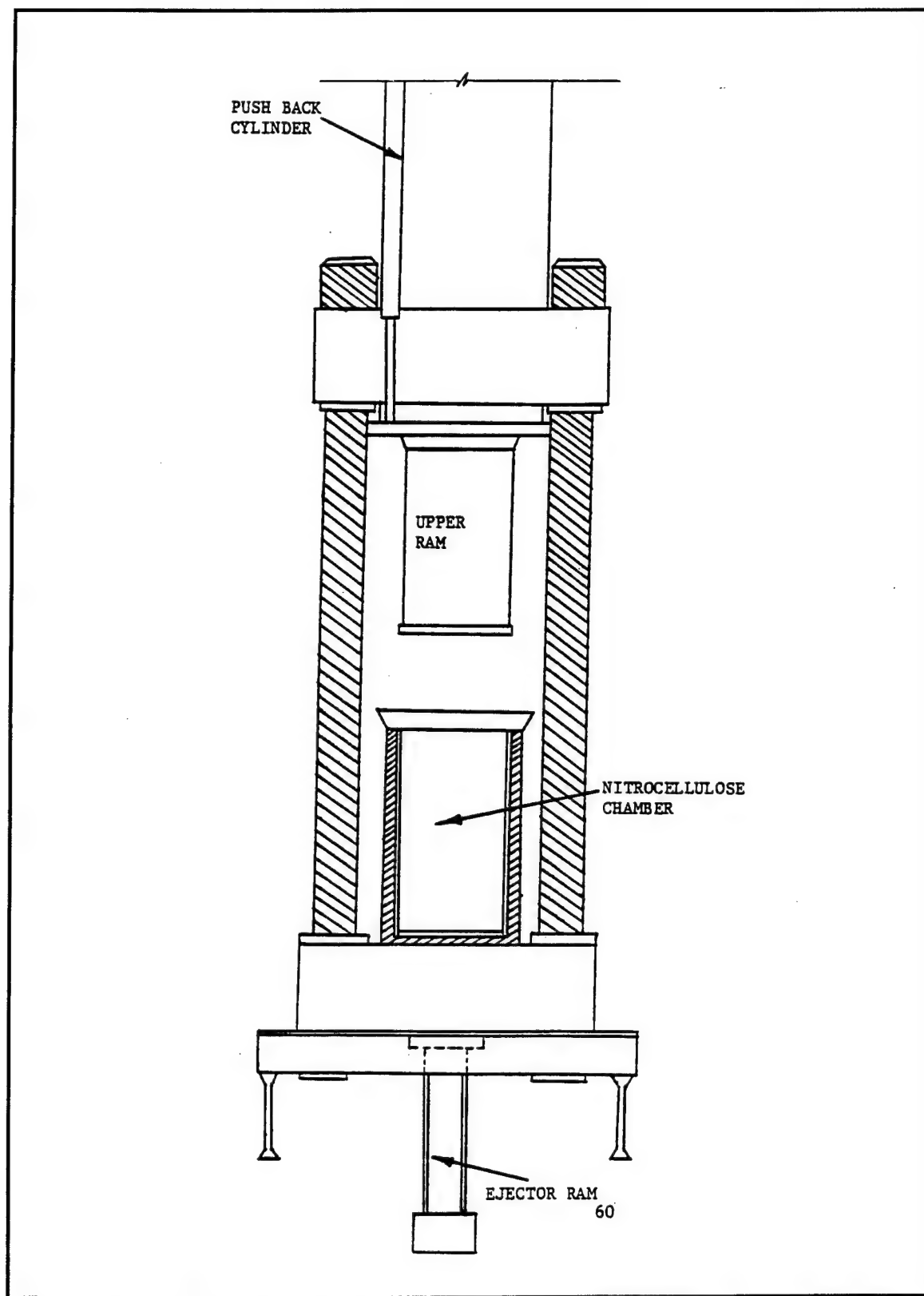


Figure 20. Diagram of a Loomis Press, used to compact nitrocellulose while adding alcohol to displace moisture (Greer n.d.).

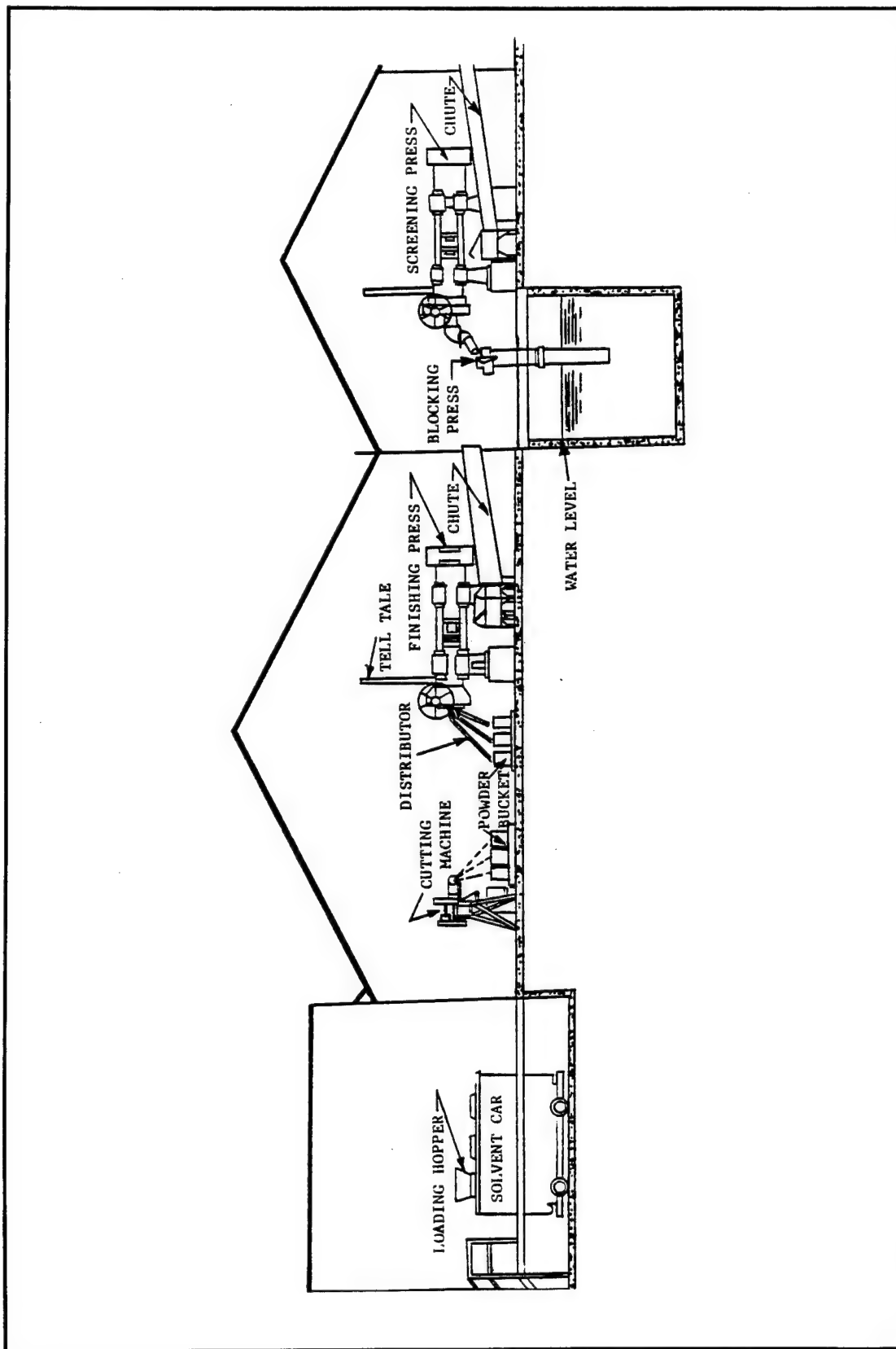


Figure 21. Equipment layout, Horizontal Pressing and Cutting House (Building 211), Indiana Ordnance Works Plant 1 (Greer n.d.).

capacity (272,154 kg, or 600,000 lbs, per day), daily production was fairly uniform; as production was pushed above this level, daily variance increased (IOW [1942]b:62).

Daily and monthly production varied with the changing production orders issued by the Ammunition Branch of the Office of the Chief of Ordnance. The method of changing these orders, which could alter production schedules by as much as 23 million kg (50 million lbs), was cumbersome and made planning difficult. Typically, a production order

was received by the Commanding Officer who transmitted it to the Contractor. Lot numbers were assigned by the Army Inspector of Ordnance at this Plant. During the intervening time between receipt of the production order and actual manufacture, the Contractor collected all manufacturing and ballistic data necessary to insure [sic] the manufacture of satisfactory material. The Powder, Explosives and Pyrotechnics Group, Ammunition Branch, Office of the Chief of Ordnance functioned as a central control for scheduling of manufacture, and submitted periodically a manufacturing schedule. With this as a guide, the Contractor, with a Government representative, prepared a granulation schedule which was submitted to the Powder, Explosives and Pyrotechnics Group for approval. These schedules were always subject to change as ordered by the Chief of Ordnance (IOW [1942]b:61).

This system was simplified, and became less subject to change, in November 1942, when the Powder, Explosives and Pyrotechnics Group began putting out production schedules listing the amount of material to be packed and accepted each month over a 12-month period (IOW [1942]b:62). Throughout the war the plant operated far above rated capacity. Daily powder production averaged about 408,233 kg (900,000 lbs) during 1943 and gradually fell to an average of about 362,874 kg (800,000 lbs) in 1944 (INAAP [1963]:11).

The effect resulting from the end of the war was immediate, as a curt one-line paragraph in the plant diary exemplifies: "1,000 Du Pont employees were terminated today" (IOW [1945]b:August 14). Operations were also abruptly curtailed. On the morning of August 15, the commanding officer "received [a] teletype . . . from the Field Director [of Ammunition Plants] directing that all production cease at this facility, with the exception of two types of smokeless powder" (IOW [1945]b:August 15). A skeleton force kept up minimized production until October 5 (Figure 23), when the final lot of powder was packed. IOW #1 had already been declared a standby facility for nearly a month. A few Du Pont employees were held back to decontaminate the plant and put it in layaway. After this work was completed, on February 11, 1946, the plant became a Government-Owned Government-Operated, or GOGO, facility (INAAP [1967]:2). The government operated the plant less than half a year before handing it back to Du Pont under a new name, the Indiana Arsenal Plant 1.

Ordnance was apparently well pleased with Du Pont's efforts and involvement at IOW #1. On the day the government took over the facility, Lieutenant Colonel John D. Armitage, who was assuming the position of Commanding Officer at the plant, presented a letter on behalf of the Ordnance Department to the outgoing Du Pont staff:

Let me say to each of you, "A job well done."

Your untiring efforts and enthusiasm have resulted in the perfection of many difficult and complex problems encountered in the manufacture of ammunition. . . . Your former Commanding Officer, Colonel Kelly H. Lewis . . . express[es] his personal congratulations and thanks for your splendid record. . . .

You have always executed all assignments given you by the War Department with great speed and noteworthy efficiency. . . . The vital part this Works played in furnishing much needed and worthwhile material to the Armed Forces is one meriting praise. "Peace" was the objective, and now that the objective has been reached a chapter must be closed. It is time to say goodbye--the road you have

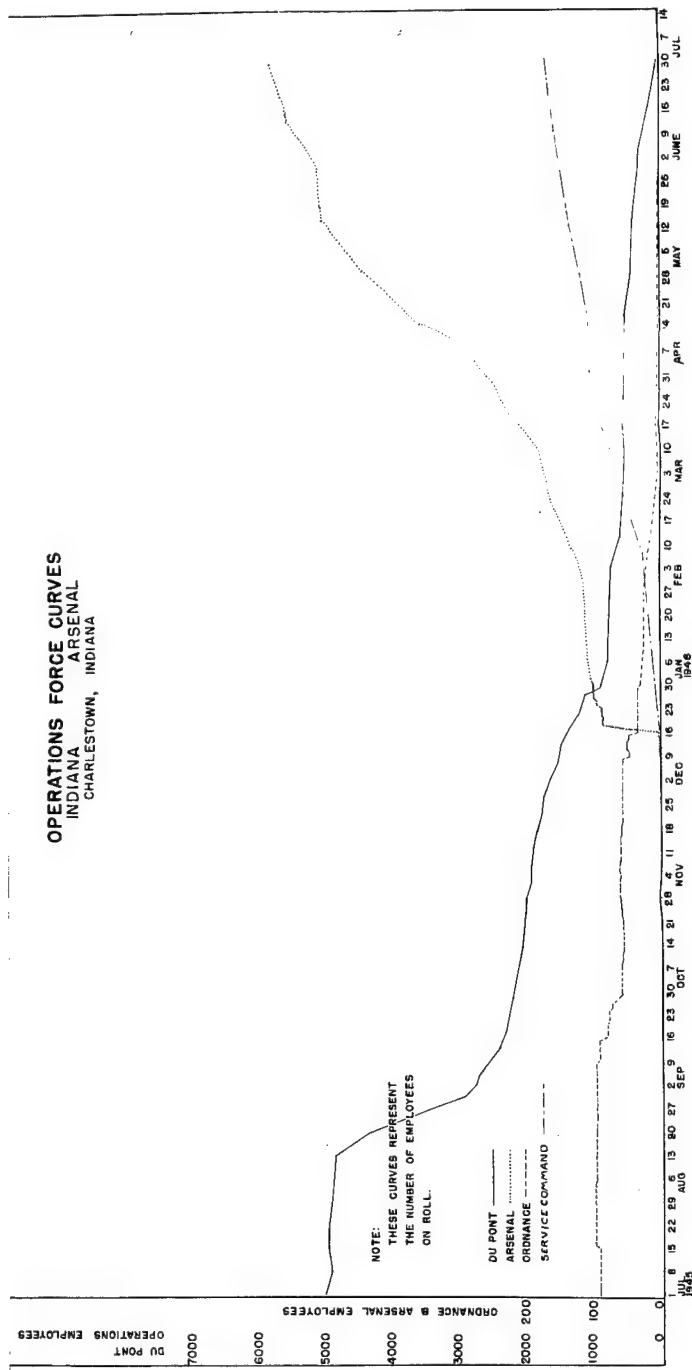


Figure 23. Du Pont, Indiana Arsenal, and Ordnance Department employees, July 1945 through June 1946 (Indiana Arsenal [1946]).

traveled has not been easy--many hard bumps were encountered in [sic] that road, but your capable organization took them all with great determination to succeed. To you, your able staff, and all du Pont [sic] employees, a "Salute of Thanks and Appreciation," from the entire War Department. . . . It has been a distinct pleasure to have been associated with your Company (Indiana Arsenal [1946]:38-39).

The Hoosier Ordnance Plant

The Hoosier Ordnance Plant (HOP) was also part of the "first wave" of defense projects, and it was in the planning stages at least as early as the beginning of construction on the powder plant. Discussions with Goodyear Tire & Rubber began in October 1940, a job offer that Goodyear president E. J. Thomas felt was "out of the blue" (Hugh 1949:533). Colonel Francis H. Miles called him one Sunday morning at his home with a simple direct request.

I'd like someone from your company to meet my train at Cincinnati tonight at 8:30. . . . We want your company to take on a bag-loading operation. It will probably call for a \$35,000,000 plant, and is extremely important to the Army (Hugh 1949:533-34).

That evening, several representatives met Colonel Miles, and he took them to Picatinny Arsenal in New Jersey so they could see what a bag-loading operation looked like. "It's like putting sugar in a bag, except you have to be more careful" remarked the engineering manager. They were surprised to find the powder was actually pellets, some resembling a small cigarette butt, others over two inches long and an inch in diameter. Goodyear thought the offer that Ordnance was making to them was quite succinct, that in effect Ordnance was saying:

Here's what the job is like. We can get people to design the buildings and contractors to erect them. What we want you to do is to draw on your manufacturing experience to lay out a plant that will permit the largest possible production,⁶ then take it over and operate it. Ordnance will furnish the schedules. It will be your responsibility from then on. We want all the production we can get (Hugh 1949:536).

Somewhat reluctant, Goodyear accepted the job.

Plant Design--Economy vs. Permanence

IOW #1 was one of the only World War II-era GOCO facilities to be built with permanence in mind, for in January 1941 the Army began economizing by altering the materials and design of buildings and layout wherever possible. With the cost of the "arsenal of democracy" escalating quickly (for example, the initial allocation of \$25,000,000 for IOW #1 had by then tripled because supplements to the original contract had significantly upgraded the facility), economy surpassed long-term durability and speed as the overriding consideration. On January 8, 1941, Lieutenant General Campbell forbade the building of brick dwellings at plants and eight days later called for the modification of administration building designs. "It is more desirable to effect economics than to have elaborate buildings," he declared to Brehon B. Somervell (Chief of Construction, Quartermaster Corps), who concurred, observing that "there has been a leaning toward grandeur" (Fine and Remington 1972:316).

⁶ Although Hugh states here that Goodyear developed the layout of the facility, at least equal credit should go to Shreve, Anderson and Walker, the architectural and engineering firm for the project, that worked closely with Hercules Powder Company, a Du Pont subsidiary, in Wilmington, Delaware. The role of Shreve, Anderson and Walker will be discussed in detail later.

Although the buildings at IOW #1 may not quite reflect aspirations toward stylistic "grandeur," they were built to last. The plans called for extensive use of brick, limestone, concrete, and steel (see Figures 5 through 10), as well as touches of architectural style lacking at facilities built thereafter, including HOP. Somervell worked with Colonel Leavey to map out a new strategy to cut costs in construction. In a memorandum to the field he stated that

there is no excuse for masonry structures, monumental or otherwise, where a light frame structure will serve the purpose. There is no excuse for the use of expensive materials where less costly ones will serve the purpose for the period of time for which the construction is being provided. There is no excuse for a heavy duty road where a lighter type will . . . provide for anticipated traffic with reasonable maintenance costs. There is no need to design railroads for a speed of 90 miles an hour within the confines of a . . . manufacturing plant (Fine and Remington 1972:317).

Somervell sent orders to all construction sites instructing commanding officers and constructing quartermasters to survey their plant plans for unnecessary frills and ways to cut costs. He ordered blueprints for permanent facilities scrapped for many late projects, including all bag and shell loading plants and some TNT and powder plants (Fine and Remington 1972:317). These directives affected HOP, but designs at IOW #1 were left intact. That plant was well into construction and scheduled to begin production in early April 1941--too far along to make changes to either construction material or layout. Photographs accompanying Rager's article show that the administration building was steel-framed by December 25, 1940, the brickwork complete a short two months later. Other buildings were well underway by then as well (see Figure 14, dated January 1, 1941). By the time the article had gone to press the building had been occupied for several months (Rager 1941b:n.p.). Other photo-documentation still at the present Administration Building confirms construction was well along by the time orders were given to scrap permanent facility plans.

The story was different at HOP, where construction was not to begin until January 10, 1941.

Cost Efficiency at Hoosier

On December 28, 1940, Contract Number W-7013-gm-1, covering the design and engineering management of the construction of the Hoosier Ordnance Plant was signed with the Detroit company Shreve, Anderson and Walker, Engineers and Architects (HOP [1942]b:4; INAAP [1963]:16). It may be impossible to know whether Shreve, Anderson and Walker (SAW) changed original designs for more permanent structures at HOP. The firm no longer exists, and no persons who could provide such information were located. (A search of records in Detroit might provide more information.) No such drawings exist now in the vault at INAAP, which contains what appear to be preliminary pencil sketches of details, but no elevations, wall sections, or other items indicating an original idea for the plant design was anything other than that which is represented in the architectural drawings still extant. According to Jim H. Potter, who was Chief Draftsman at the facility for the 28 years prior to 1993, architecture firms typically discard all but their final drawings (Potter, interview 1994).

There was enough time for many designs to have been underway at SAW's offices. Although government documents differ on when SAW was awarded the CPFF contract, the most likely date is December 28, 1940 (HOP [1942]b:5). The order to discontinue designing brick buildings came January 16, giving them almost three weeks to work--not much time in an ordinary situation, but this was no ordinary job. However, the plant diary fails to mention any work performed by the firm until January 15, after which there are many comments on the progress of the design work. This would seem to indicate only nominal work, if any, had been undertaken prior to the issuing of the new directives.

SAW set up an office in Wilmington, Delaware, where the Hercules Powder Company had its home office, and entries in the plant diary show the two companies worked together closely, with SAW eventually

establishing a representative at Hercules' offices (HOP [1942]a:April 4, 1941). Estimates of how much land would be needed--2,023 ha (5,000 ac)--were based on Shreve's visit to one of Hercules' plants that January. Ordnance had counted on purchasing only 1,416 ha (3,500 ac) prior to that visit (HOP [1942]a:January 20, 1941). By January 22, SAW had gone over "a couple of layouts" with the engineers at Hercules and some of Goodyear's representatives. These layouts probably served as general guidelines for the Charlestown facility. Later Hercules began providing SAW with preliminary and final drawings for structures (HOP [1942]a:April 4, 1941), as well as equipment layout plans (HOP [1942]a:June 1, 1941).

The plant was divided into two areas, the explosives area encompassing about three-fourths of the property, and the inert area where there would be no powder. The planning of the inert area posed no problems since the buildings therein could be conventional factory structures. This included the huge Bag Manufacturing Building (Figure 24), a single-story structure covering 2 ha (4 ac) and housing 1,500 power-driven sewing machines, slitting machines, and conveyors to carry material through the building (Hugh 1949:538).

But the planning of the explosives area was quite another matter. Safety quantity distances (the safety zone separating buildings in which explosives were stored or handled) had to be observed, which was difficult since new data were altering these distances even as planning was underway. One plant diary entry gives a good example of how changing information could affect a large portion of the layout: "The administration building has been moved 250 feet south to clear safety distance of 2155 feet. The inert warehouse also had to go 250 feet. No difficulty except the employment building may have to be moved to the north of the main road and it will probably be in one end of the parking area" (HOP [1942]a:April 11, 1941). Safe distancing had to be considered for building groups, like the sets of LAP buildings (Figure 25), as well as for individual buildings in a group (Figure 26).

A prime consideration in the design of the buildings themselves, the most important of which were the loading lines and the storage igloos, was necessarily the nature of the materials that were to move through them. In reference to the loading lines,

no conventional factory building would do there. Only so much powder could be present in any building, only so many people could work in a room. . . . The loading building had hoppers for the powder on the second floor and gravity feed down to a series of loading booths on the first floor. None of these loading booths connected with any other, and the bags when loaded were carried on a transfer chute to a center aisle through double doors, only one of which could be opened at a time so that air could not go from one [loading booth] to the other (Hugh 1949:539-541).

In addition, the loading line buildings had to be designed such that several different kinds of charges could be packed there, giving the plant the flexibility to meet the changing requirements of Ordnance and the front line forces.

In the inert area, original administration building plans called for a structure that would serve during both the construction period and operations. Modeled on temporary structures for the contractors offices at IOW #1, which were thought to be "as compact and centralized as possible," the building was to have a main section, 165 by 12 m (540 by 40 ft), and six wings each 73 by 12 m (240 by 40 ft). But delays in procuring land in the most desirable area for this structure made the construction of separate administration buildings necessary--one suiting the immediate needs of the engineers and construction contractor and another to house the administrative staff in charge of operations. Therefore, the size of the operator's administration building was reduced to incorporate only four wings (Figure 27). The design of the building was, "in accordance with instructions from the Office of the Quartermaster General, . . . to provide a suitable structure appropriate to the expected five-year life of the project, thus minimizing construction costs. Plans of Mobilization Buildings, Administration Buildings, No. 700-396 to 700-399, one-story buildings of an inexpensive frame construction, were followed" (HOP n.d.a:2-3).

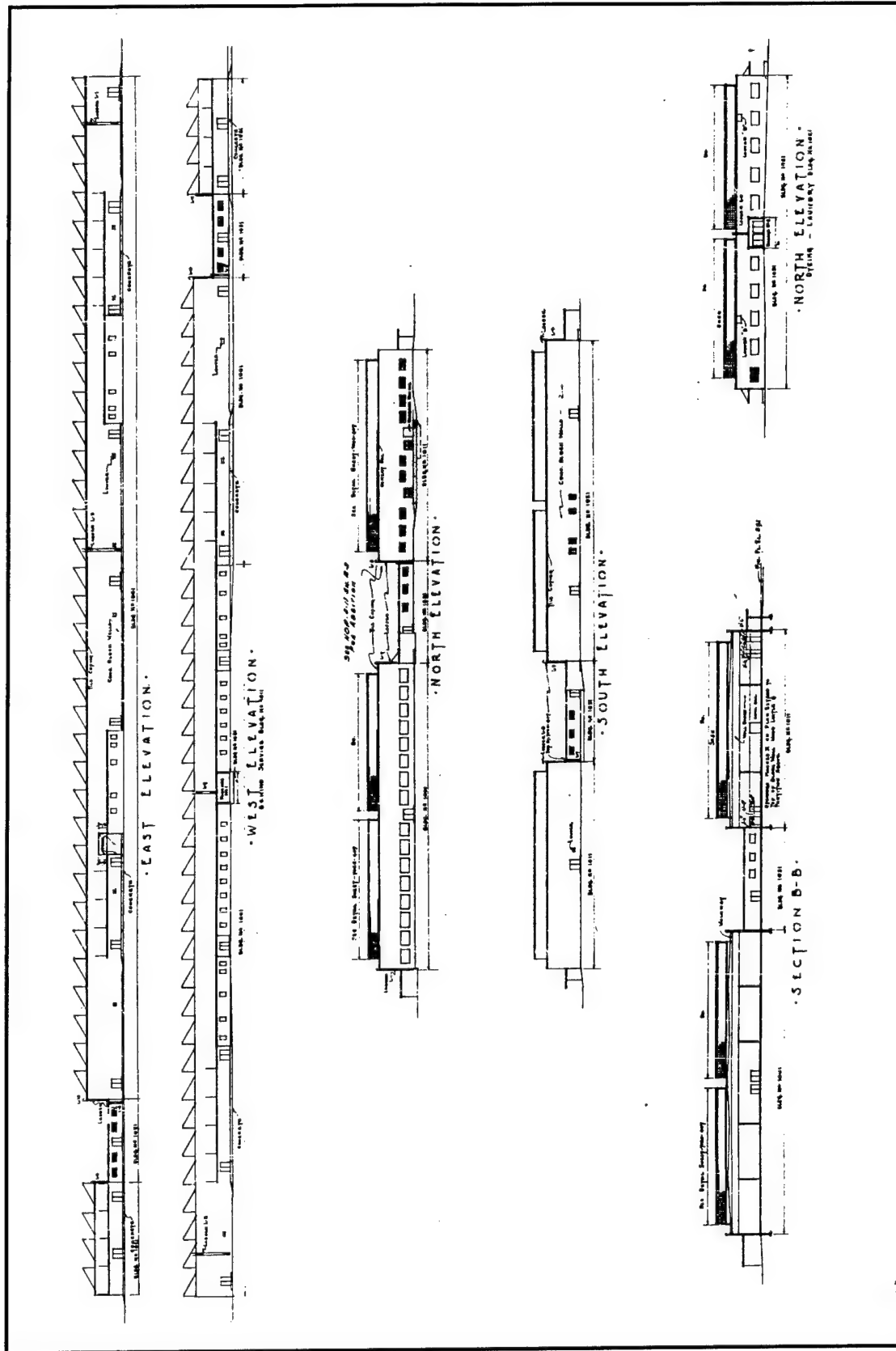


Figure 24. The bag manufacturing building group (buildings 1001, 1011, 1021, and 1031), Hoosier Ordnance Plant (INAAP Drawing 7020-402).

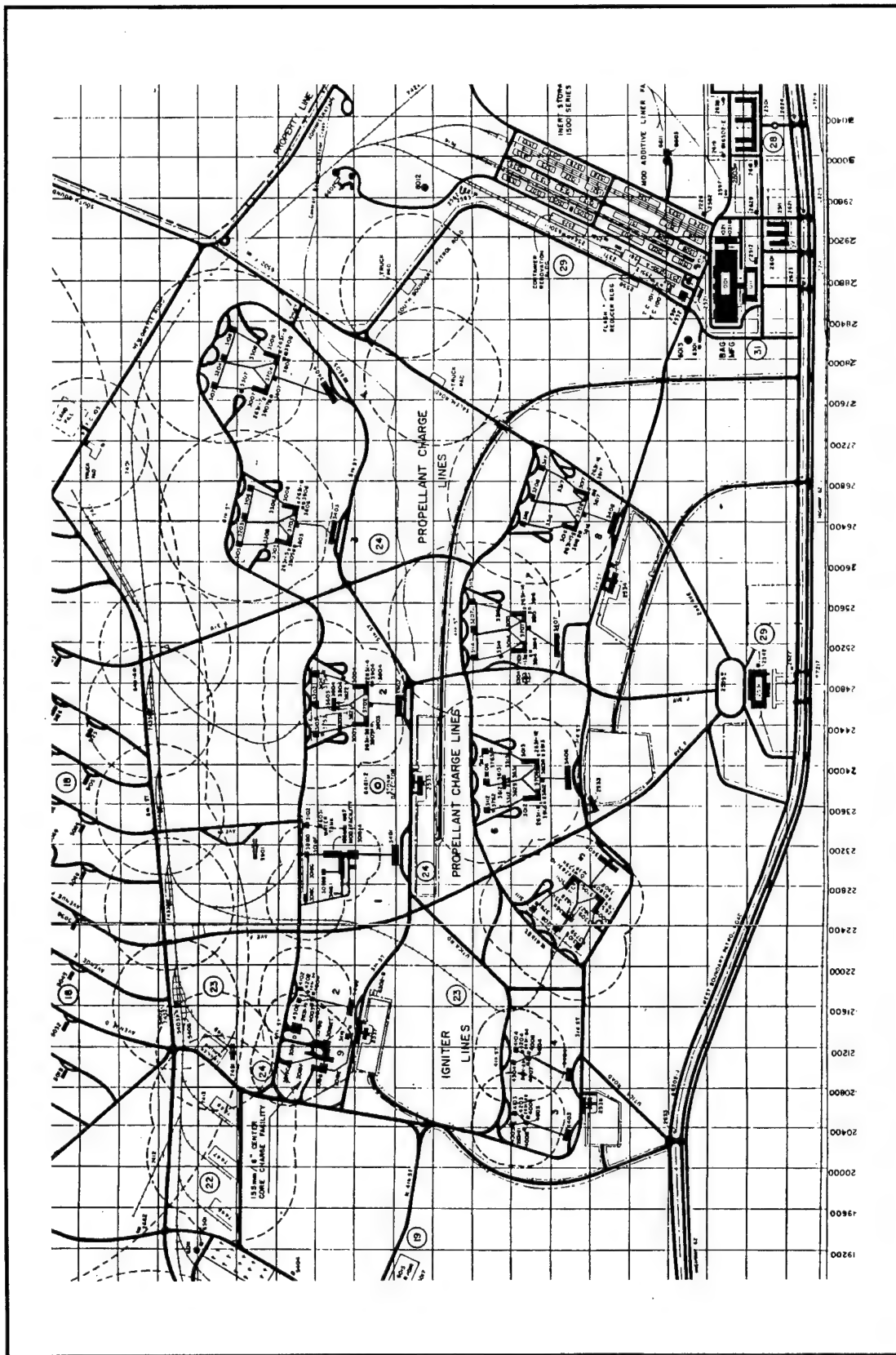
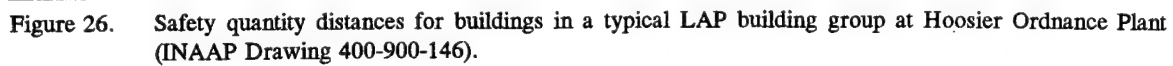


Figure 25. Safety quantity distances for the LAP buildings at Hoosier Ordnance Plant. The igniter lines, where black powder was loaded, are on the left (INAAP Drawing 400-900-142, sheets 7 and 8).



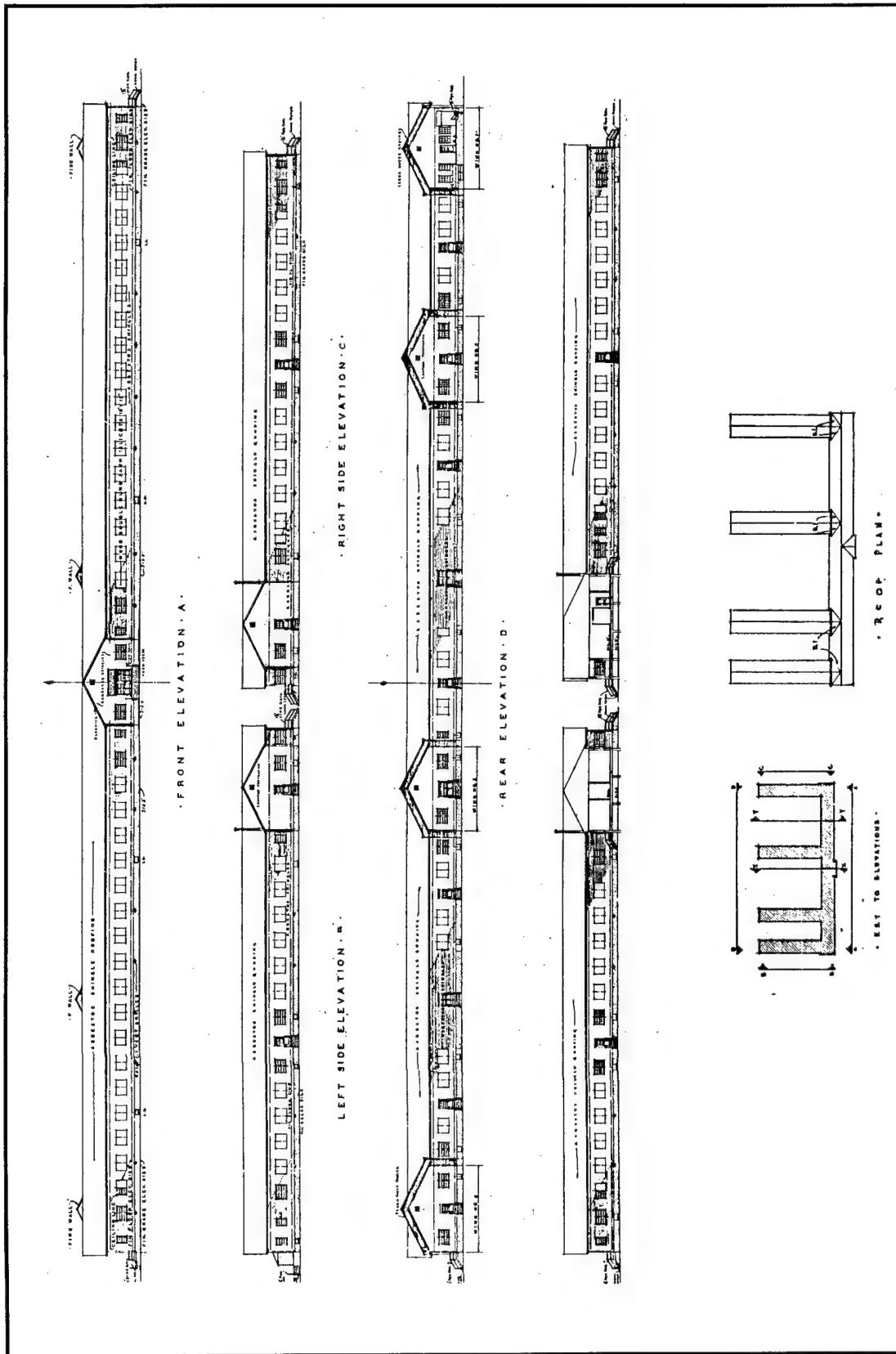


Figure 27. Elevations, Administration Building (Building 2501), Hoosier Ordnance Plant (INAAP Drawing 7020-123).

These Series 700 drawings were for temporary structures, expected to last, as stated above, approximately five years. In contrast, the permanent structures to the north at IOW #1 were expected to last at least 20 years. But like thousands of other such structures built during the World War II era, most of these “temporary” buildings are still standing after more than 50 years.

Plans for the Series 600 buildings, the precursor of the Series 700, were first drawn in 1917 (Wasch et al. ca. 1992:3), then modified over the two decades that followed. Major Elsmere J. Walters, then Advisory Architect of the Construction Division of the Quartermaster Corps, drew up finalized versions of the Series 700 between 1937 and 1940 (Garner 1993:33).⁷ These buildings were similar to World War I structures, the primary outward difference being that the World War II buildings were painted instead of being left to weather, as were buildings in the previous war. Although it does not appear to be the case at HOP, the interiors of these buildings at some other locations were left unpainted throughout the war, and exterior walls at most locations were neither insulated nor sheathed (Garner 1993:35).

Architectural standards in the Series 700 buildings were upgraded considerably over those of the Series 600 drawings. Stud construction replaced plank frame construction and concrete piers and footings replaced treated-timber posts. These attributes are found in the buildings at HOP. But,

a distinctive feature peculiar to Series 700 buildings was a skirt-roof that projected from the spandrel wall above the ground-story windows on two-story buildings, and continued around all four sides. On both the single-story and two-story buildings, it also extended the eave line beneath the front and rear gables to span the width of the building. Other terms used to describe this skirt-roof were ‘canopies’ and ‘eyebrows.’ The official term used by the army to designate this feature is ‘aquamedia,’ [or aqua media] and its origin is as uncertain as its Latin derivation. Whatever its ontology, aquamedia was of questionable value (Garner 1993:41).

Meant to allow windows to remain open for ventilation while it was raining, the feature was dropped from Series 800 buildings because it was largely ineffective against blowing rain, and leaks occurred where the rafters for the eaves were framed into the wall (Garner 1993:33-41). Although this feature was “distinctive” and “peculiar” to buildings in the 700 series, it was not a feature of all the buildings in the series, and its conspicuous absence at HOP should not be construed as a design alteration on the part of SAW. Drawings in the 700-396 to 700-399 range were not located, but elevations for a 700-376 building suitable for administrative building construction which was located shows no use of aqua media (Figure 28).

The administration area buildings resembled the standard Series 700 design in their use of concrete pier and wood beam foundations, their use of wood for framing members, and of asbestos siding (Figures 29 through 31). In contrast to the norm, however, the interior walls were sheathed with wall board, interior partitions were extended to the ceiling and were “composed in part of glass in order to minimize inter-office noise and at the same time to provide maximum light” (HOP n.d.a:4). Asbestos shingles were used on both exterior walls and the roofs “because it offered excellent fire protection, because its original cost was low, and because maintenance costs were negligible” (HOP n.d.a:4).

⁷ There is another version of how these plans came about. Brigadier General Charles D. Hartman did the original work on the Series 700 drawings in the 1930s, then left for an assignment in California. In this alternate version, when he returned to Washington in March 1940 to head the Construction Division of the Office of the Quartermaster General, he found that “in his absence, someone [Major Walters?] had markedly altered the plans, changing them so they could no longer be used. Furthermore, the remainder of the plans had disappeared” (Wasch et al. ca. 1992y:11). Hartman’s response was to set up a Construction Advisory Committee and include prominent U.S. architects and engineers. “With this sort of leadership, the engineers and architects at the Ft. Myers warehouse cum design studio were able to deliver the drawings--the latest, revised version of the 700 Series--on time” (Wasch et al. ca. 1992:12).

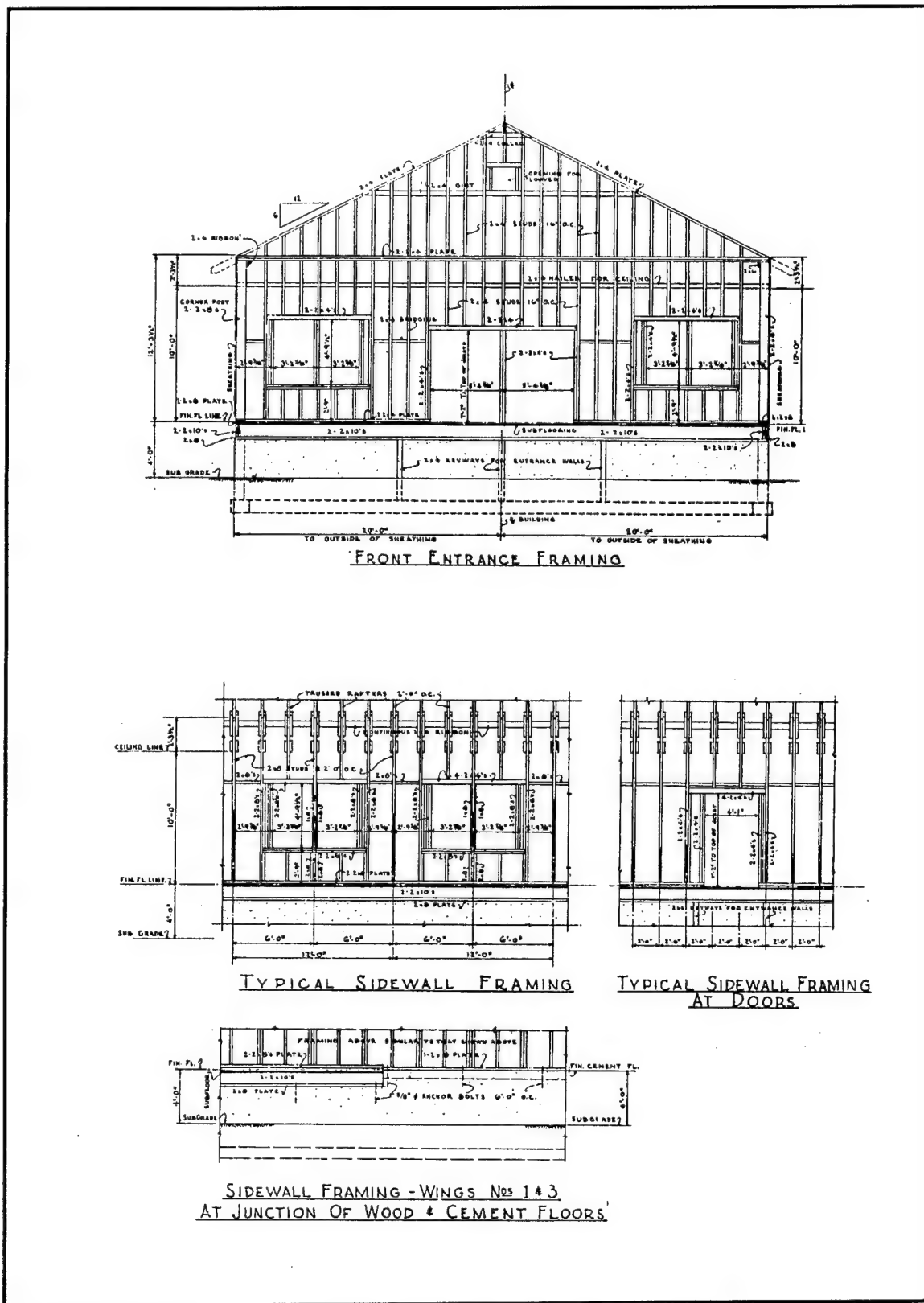


Figure 29. Like the Administration Building (Building 2501) shown here, most buildings at the Hoosier Ordnance Plant were built with wood framing members (cf. Figures 11, 14 and 15, showing steel framing at Indiana Ordnance Works Plant 1) (INAAP Drawing 7020-282).

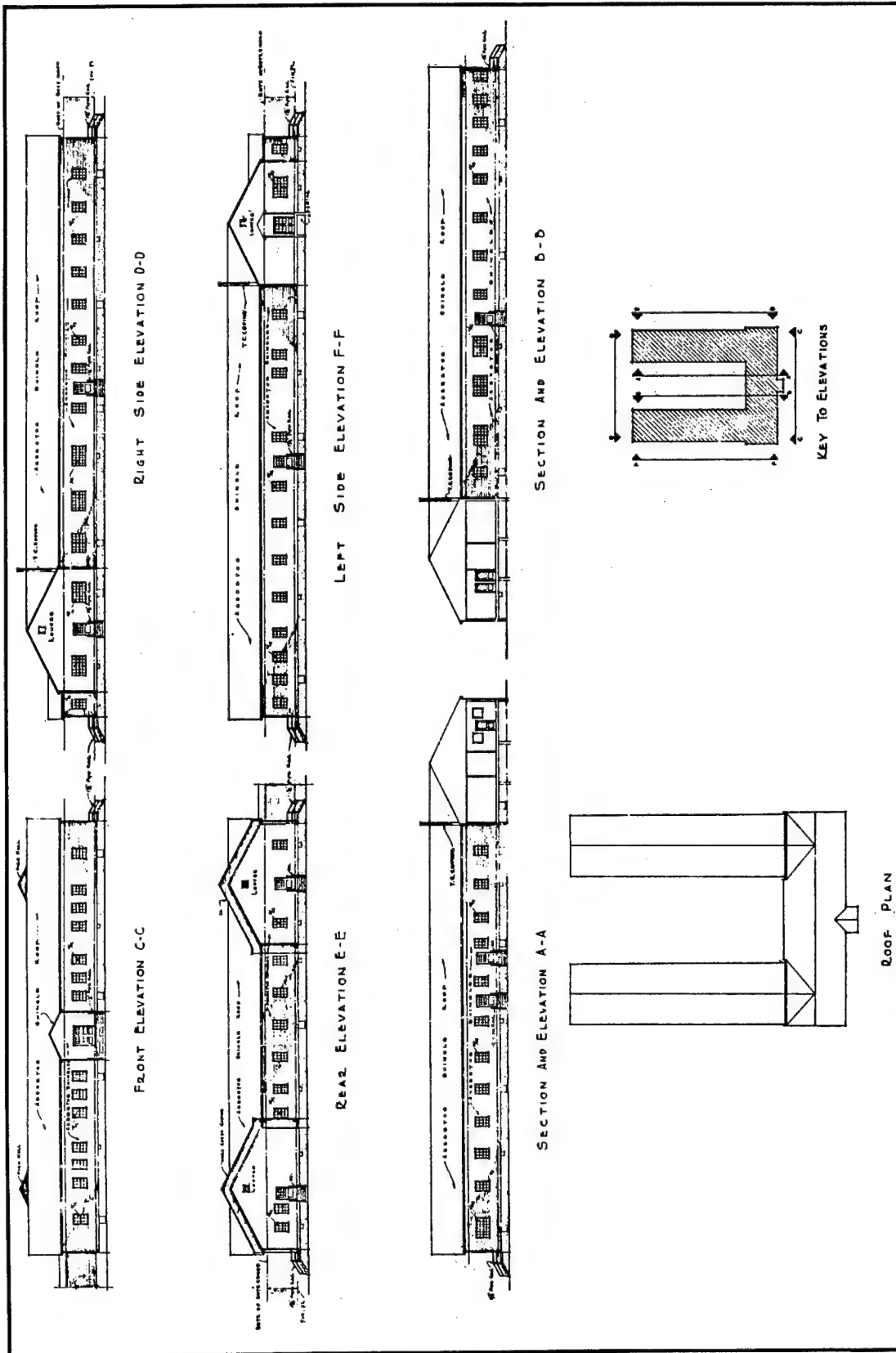


Figure 30. Elevation, Employment Building (Building 2511), Hoosier Ordnance Plant (INAAAP Drawing 7020-182).

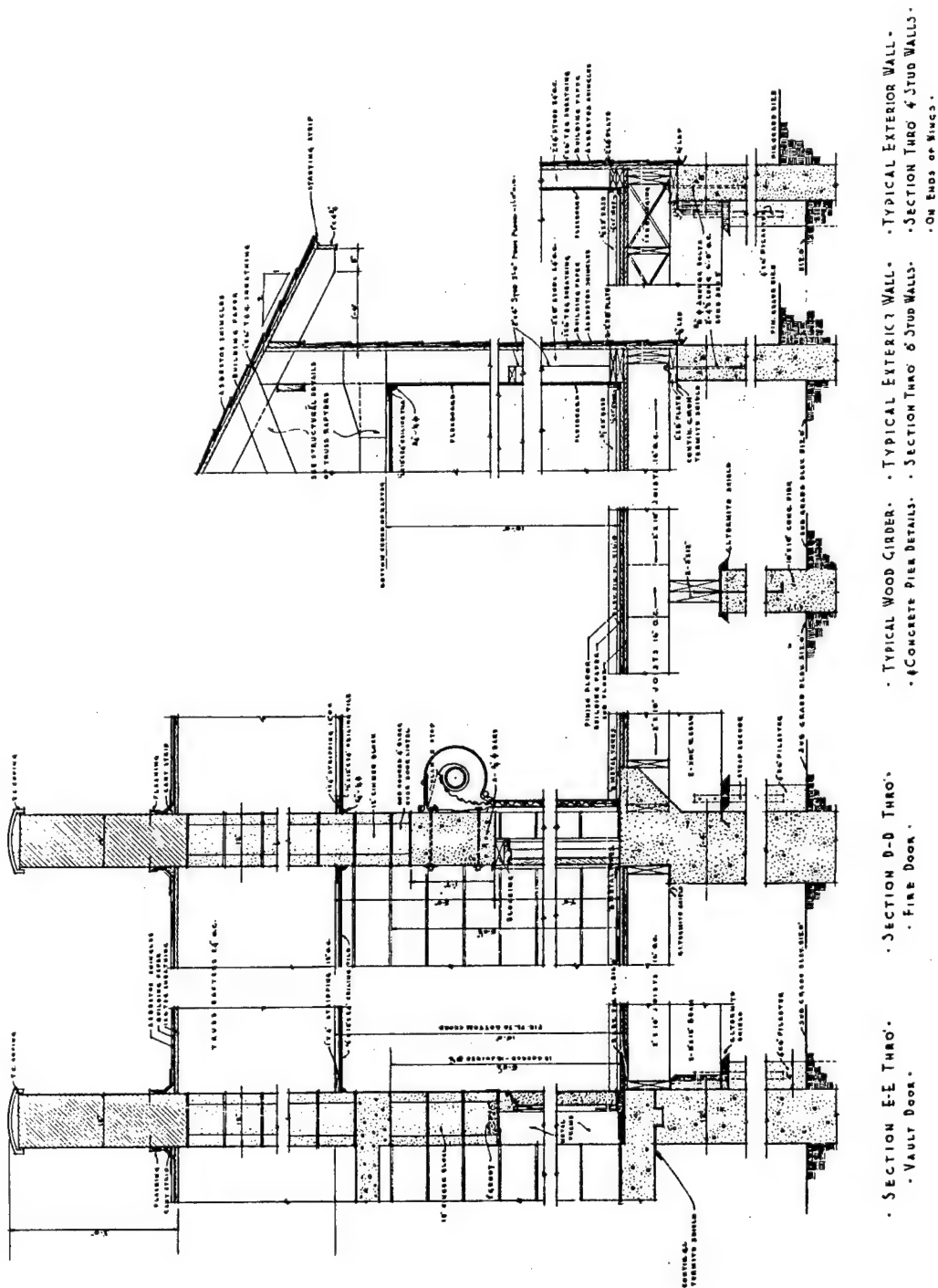


Figure 31. Wall sections and details, Employment Building (Building 2501), Hoosier Ordnance Plant (INAAP Drawing 7020-124).

Even though these were not strictly temporary structures and thus did not result in the greatest possible savings for the government, they did cut cost in half in some areas (Table 1). It would be impossible to simply look at overall costs of the two plants and compare the number of buildings and floor space of those buildings since so many of the structures at the two facilities differ greatly. For instance, there is nothing comparable to a nitrating house at HOP, and nothing comparable to a bag loading building at IOW. The processes such buildings housed influenced the nature of the design and the materials with which they could be built. A more revealing comparison should look at only comparable buildings, standard structures requiring only typical building techniques and designs, such as the administration buildings, change houses, and miscellaneous support buildings. The bag manufacturing building at HOP could be included, since, as noted below, it was a conventional factory structure with no special construction requirements. The average savings in construction cost appears to be, for this type of structure, over \$100.00 per sq m (about \$10.00 per sq ft). A somewhat similar savings can be assumed for other portions of HOP that did not require the more permanent type of construction taken as the order of the day at IOW #1.

Table 1
Construction Costs for Selected Buildings at HOP and IOW #1

Building Name	Area (sq m)	Cost (Total)	Cost (per sq m)
<u>IOW</u>			
Administration Building	6,985	2,150,200	307.83
Main Cafeteria	1,183	227,200	192.05
Fire Station	341	84,500	247.80
Change House Series	7,940	1,548,500	195.03
General Instruction Building	<u>124</u>	<u>8,000</u>	<u>64.52</u>
Average			242.47
Total	16,573	4,018,400	
<u>HOP</u>			
Administration Building	5,019	934,500	186.19
Main Change House/Cafeteria	4,458	472,700	106.03
Employment Building	1,616	419,000	259.28
Bag Manufacturing Building	15,505	1,789,900	115.44
Dye House/Laundry	<u>1,675</u>	<u>324,400</u>	<u>193.67</u>
Average			139.37
Total	28,273	3,940,500	

Source: INAAP [1989]:various.

The LAP process at HOP involved several steps--the preparation of the cloth by washing and dying, cutting the pieces for the bags, printing the charge numbers on the bags, and sewing up the finished product. Most of these steps took place in the Bag Manufacturing building.

"In the planning of this building, considerable pioneering was necessary since no data were available pertinent to a building of this size and type" (HOP n.d.b:2). It also needed to be functionally efficient and designed to be quickly erected. A one-story design was chosen for this and the other buildings in the group (the Dye House/Laundry and the Cafeteria/Change House) because it would facilitate the flow of materials and put the least restrictions on the arrangement and sequence of steps, as well as minimizing distance and eliminating the need for elevators. Furthermore, the one-story construction permits the fullest use of natural light, an important point for period architects.

SAW incorporated several then-contemporary design elements into the 67 by 226 m (220 by 740 ft) building. The structure was unadorned, "honest" in Modernist Architecture terminology, its exterior stripped of ornamentation. Aesthetic expression on the interior eschewed ornamentation as well, the Modern ideal concept of beauty being a perfect integration of design and the industrial process, which entailed the elimination of unnecessary details. A sawtooth roof was selected because it would supply the greatest amount of natural light,⁸ which was supplemented by 900 three-tube florescent fixtures. To protect the health of the workers, fans were installed capable of making a complete change of air every six minutes. And the placement and number of exits would allow the entire building to be evacuated in 15 seconds.

Unlike the explosives buildings, usage placed few restrictions on what materials could be employed for construction in this building group. "This latitude was fully exploited by the choice of the most available, as well as the most economical, products, thereby nearly eliminating delivery delays" (HOP n.d.b:10). Concrete blocks were chosen for exterior walls here and in other buildings because they were relatively inexpensive and, at least when the building was designed, readily available. As it turned out, the blocks were not as readily available as the architects thought, and dependence on this material caused "the nearest thing to an actual delay." Many small vendors had to be contacted to purchase sufficient quantities, and delivery schedules were so tight that workers almost had to set blocks taken directly from incoming delivery trucks (HOP n.d.b:10).

Construction at HOP

As mentioned in a previous section, there was a heated debate between the Quartermaster Corps and the Ordnance Department about whether comprehensive contracts, covering everything from design to operation, should be awarded to a single firm or whether work should be split between contractors, spreading the wealth of defense contracts. In argument for the latter and in support of the Quartermaster Corps stance, one Southern congressman complained that the War Department seemed "to take care of the big people, mak[ing] the big still bigger, . . . leav[ing] the little people struggling to get along out in the cold" (Fine and Remington 1972:190).

It can be supposed that at least the appearance of spreading the wealth was part of the reason the construction contract at HOP was awarded to four firms: Winston Brothers Company and C. F. Haglin and Sons, Inc.

⁸ At a general progress meeting where several Ordnance, Goodyear, and HOP staff were in attendance, Shreve seems to have declared rather than suggested the use of the sawtooth design. "Mr. Shreve asked the question as to how much glass they should have in the sky light. The way it is now being sketched up, a saw tooth with vertical side facing to the north. There have been other plans on it but the saw tooth seems to be alright. It is a question of how much glass they should have and what arrangement for black out. . . . Col. Hardy asked how the cost of the saw tooth compares with others. Mr. Shreve said it is a little more" (HOP [1942]a:March 17, 1941). That was the end of the subject.

of Minneapolis, Minnesota; Missouri Valley Bridge and Iron Company of Leavenworth, Kansas; and Sollitt Construction Company, Inc. of South Bend, Indiana (HOP [1942]b:5). The contract for the construction, Contract No. W-7013 qm-2, was signed January 10, 1941. Such a coalition was probably just what the Quartermaster Corps was hoping to find--the four together were large enough to handle logistical requirements concerning the gathering of labor, equipment, and materials, yet they were four different entities separated geographically.

Known at the construction site as WHMS, the four companies had formed a joint venture some months earlier to better enable them to secure defense contract work, becoming a major contracting group and doing work for Ordnance all over the contiguous states. On each of their contracts, one company would act as the managing partner and essentially run the job, the three other partners helping locate and supply labor and working capital. Winston Brothers Company was most likely the managing partner at this construction site according to Bob Roberts, who has worked at C.F. Haglin and Sons, Inc., since 1946 and "looked after" WHMS history in the 1950s (Roberts, interview 1994).

To better manage and supervise construction and to facilitate the division of responsibility, the project was split into six areas:

- Area 1: Buildings and appurtenances involving the manufacturing of powder bags and facilities required for inert storage,
- Area 2: Administration and service buildings,
- Area 3: Structures and facilities for propellant charge loading,
- Area 4: Structures and facilities for igniter charge loading,
- Area 5: The magazines, or igloos,
- Area 6: All utilities such as water supply, sewers, electric and process lines (HOP [1942]b:5).

WHMS assigned an engineer to each area, and the government likewise appointed inspectors for each to ensure quality and conformity to recognized construction practices.

SAW submitted its soils data to Ordnance at the end of February, along with a note that subsurface rock would cause quite a problem in the installation of water and sewer lines, adversely affecting cost (HOP [1942]b:17). But excavation was merely an inconvenience compared to the much greater problem of finding the equipment to do that excavation, and the other tools and machinery needed at the job site. Just as at IOW #1, an enormous amount of equipment was required, and procuring it proved to be one of the most difficult problems during construction.

Because the project required the excavation of over 4,700,000 cubic yards [3,600,000 cu m] of material, extensive filling, earth-moving, grading, landscaping, and because the emergency schedule necessitated working in many areas simultaneously, a huge amount of equipment was required. Altogether 965 pieces, valued at \$2,257,415, were rented for a total of \$2,439,545, of which \$1,560,070 accrued as government equity. All of this equipment had to be procured during the height of a defense-born, nation-wide, equipment shortage, especially of tractors and earth-moving machines so vitally needed on the Hoosier site (HOP [1942]b:12).

The shortage may indeed have been nation-wide, but finding equipment for use at HOP was particularly troublesome since their neighbor to the north was still tying up so much of what was available locally.

WHMS originally proposed buying the necessary equipment, but the Office of the Quartermaster General pointed out that it was impossible to predict exactly what equipment would be needed and tried to persuade the contractor to rent instead. But companies willing to rent were few and far between, so it seems that WHMS struck out on its own, committing to agreements that the Zone Contracting Quartermaster reluctantly went along with when necessary. WHMS determined what it would need, largely guesswork since the

information they had about the work to be performed was scanty, then asked for both lease and sale quotations from several manufacturers and dealers. "From the start it appeared that many of them would not be able to fulfill the requirements and that securing the equipment would be a Herculean task" (HOP [1942]b:12). Because of the high demand, many dealers would not even quote rental terms, and some said delivery dates would be impossible to state for certain.

Due to the pace of construction set by the state of emergency, WHMS decided that commitments had to be made as soon as they could locate equipment suppliers who could promise timely delivery, and it did so on its own authority. Some of the equipment was to be delivered to the job, other items were to be held by manufacturers until further notice. However, since WHMS did not have the authority to do this, when purchases were referred to the Zone Construction Quartermaster they were refused.

WHMS were obligated to go through with the commitments made to whatever extent the manufacturers and dealers desired to hold them. Hence, when a canvass of rental equipment was made, it was necessary to require prospective bidders to use this equipment already purchased, and to assume obligations which WHMS had already incurred (HOP [1942]b:13).

When the Zone Construction Quartermaster and the Office of the Quartermaster General made their own equipment searches, they also could not locate satisfactory suppliers. Toward the end of March agreements were executed with two primary suppliers. Corum Brothers, from Madisonville, Kentucky, were to supply tractors and earth-moving equipment. Truman Bowen and J. L. McLaughlin, of Fort Peck, Montana, would be responsible for shovels and trucks. These two companies could not supply all the equipment that was needed, so agreements were entered with 25 other firms for the remainder, mostly minor equipment such as vibrators, welding outfits, drop hammers, and pile drivers (HOP [1942]b:13).

All equipment was checked in as it arrived at the construction site by representatives of the government and WHMS. There were "frequent downward adjustments" of valuation, which influenced the rental rates. Although about 90 percent of the equipment was new, some items were not even in working condition and so were either rejected or repaired at the lessor's expense, and the rental period did not begin until the item was in sound working condition. WHMS was responsible for keeping it that way. When no longer needed, equipment was returned to the lessor or transferred to another government project as quickly as possible (HOP [1942]b:13).

Some of these contracts caused problems later, especially the one with Corum Brothers, which seems to have been awarded at terms more favorable than the government usually allowed. In June 1943, a *Louisville Times* reporter named Hughs called the Ordnance Department's commanding officer at the plant, requesting information concerning Lieutenant Colonel Hauck, a former Ordnance officer assigned to the plant.

Mr. Hughs advised that his interest in this matter was based on an indictment having been returned by the Federal Grand Jury at Indianapolis this past week and which was entered in the Federal Court in Louisville, Kentucky, this morning by Mr. Eli [H.] Brown [III]. This indictment was premised on what it termed fraudulent practices involving the procurement of equipment for Indiana and Hoosier Ordnance Plants, involving several million dollars. The indictment named the Corum Brothers and Mr. Charles N. Hikes, who was Government Equipment Inspector directly under Lt. Col. Hauck. The indictment further stated that Lt. Col. Hauck was not named therein because he was an Army Officer and subject to the jurisdiction of the Army only. . . . He inquired as to whether Lt. Col. Hauck had any relatives in the Army at this time. I told him not to my knowledge but that his brother was Chief Engineer on [the construction of?] the Pentagon Building in Washington (HOP [1944]a:June 26, 1943).

A clipping from an unidentified newspaper attached to the June 26 entry listed the charges as "conspiracy to defraud the Government and to present and collect false claims. . . . The 'fraudulent practice' was

described as involving excess charges for equipment used in construction of the plants furnished through sub-contracts and to which the Government eventually was to have obtained title" (HOP [1944]a:June 26, 1943).

Another major difficulty involved the terrain. A swampy area, apparently not discovered until workers began clearing the site in May 1941, lay across the proposed location of the Bag Manufacturing Building.

This necessitated a 4-foot cut in solid rock at the northern end of the building, and an 8-foot fill at the southern. Hence it was necessary to support this end by piling, placed at 10 foot centers, on top of which a beam construction was placed to support the floor. Extremely heavy drainage requirements in this section were taken care of by numerous underground catch basins leading directly into storm sewers (HOP n.d.b:8).

Even with this foundation the floor still had to be unusually thick. A 15-cm (6-in) slab was overlain by sleepers that had been soaked in creosote, covered by a 5-cm (2-in) subfloor, felt paper, and maple flooring.

Washington was not particularly pleased with progress during the first few months of construction, doubting the plant could be completed on schedule and into production in September. Colonel Hardy (then plant commander and area engineer for construction) echoed the sentiments of his superiors in a June 1941 meeting at HOP, in which he lay partial blame on the flow of command one had to wade through when purchasing materials. He asked for and was granted the authority "to buy in the field and not have to take everything up with Washington; to use the next best thing within a reasonable price as long as it will serve the purpose; to decide on substitutes for critical items right here and now" (HOP [1942]a:June 1, 1941).

But these changes would only be of marginal assistance if the plant's priority rating was not changed as well. "Mr. Shreve mentioned tanks--the tank contractor--Caldwell--advises that he has lost his priorities at least three times and is now talking about deliveries next Christmas." Something had to be done to keep construction even close to schedule. "Mr. [W. K.] Maher said Colonel Groves is to have a conference with General Campbell [Chief of Ordnance] on Monday morning to try to get a new priority on this plant--possibly A-1-b instead of A-1-h" (HOP [1942]a:June 1, 1941).

As a result of that meeting with General Campbell, a Captain Sheets called regarding the likely completion date of the facility. Could it be completed on schedule, by the first of September? He was told the plant could go into partial operation by September 24th. Nearly full operation by the 24th would be possible *if* they could get a higher rating. Sheets drew his own darker conclusion, saying that it seemed to him the facility looked highly unlikely to go into operation until October, perhaps not until November. The commanding officer told him "his deductions were correct" (HOP [1942]a:June 19, 1941). The priority rating was raised to A-1-b with a special priority of A-1-a.

Once these changes were in place, work was all full speed ahead (Table 2). Quick completion was essential if the Ordnance Department were to keep ahead of increases in supply shipments to Europe. When the commanding officer requested permission to allow the contractor to work overtime, the Zone Constructing Quartermaster replied by forwarding a telegraph they had just received from Washington.

YOU ARE DIRECTED TO PUSH THE WORK AT YOUR PLANT TO THE MAXIMUM EXTENT CONSISTENT WITH ORDERLY PROCEDURE PERIOD WORK WILL BE PUT ON SHIFTS AND YOU ARE AUTHORIZED TO APPROVE SUCH OVERTIME AS WILL PROVIDE FOR EARLIEST POSSIBLE COMPLETION OF THE PROJECT CONSISTENT WITH ORDERLY AND EFFICIENT WORK END B SEVEN NAUGHT FOUR M GREGORY. (HOP [1942]a:June 11, 1941).

Table 2
Building Completion Schedule at Hoosier Ordnance Works

	1	2	3	4	5
<u>1941</u>					
April 26	9	4	1		
May 31	94	8	1		
June 28	213	57	19		
July 26	304	159	78	2	
August 30	419	330	191	23	
September 27	489	407	343	113	
October 25	504	434	414	312	
November 29	516	505	497	468	364
December 27	517	517	517	513	509
<u>1942</u>					
January 31	518	518	518	518	517
February 7					518

1. Number of buildings laid out.
 2. Number of foundations complete.
 3. Number of buildings with walls and roofs complete.
 4. Number of buildings completed.
 5. Number of buildings accepted.
- Source: HOP [1942]b:310-311.

Outside the bureaucratic entanglements, natural forces lent an impeding hand to the pace of construction in at least one area. There were 177 igloos to be built for the storage of smokeless and black powder. Construction specifications called for the use of large amounts of concrete, approximately 237 cu m (310 cu yd) per unit. Crews began pouring concrete in the first week of April, but bad weather ensued and forced the work to fall behind schedule. The return of more moderate conditions allowed the pace to increase but not enough to catch up. The area was not turned over to Goodyear until November 12, 1941, nearly six weeks behind the scheduled completion date (HOP [1942]b:20).

With so much work in progress both in the area and around the country, locating enough workers to keep construction moving along fast enough to satisfy the Ordnance Department, and keeping those workers satisfied, could have been a monumental problem. That it turned out not to be so is probably testament to the value of steady employment during those closing years of the depression and to the higher wages paid at both the sites. Everyone who possibly could, wanted to work, especially for the high wages being paid.

There were over 13.5 million person hours expended in the construction of HOP, accounting for more than \$6,800,000, or 40 percent, of the cost of construction⁹ (HOP [1942]b:21). Employment hit its peak on August 20, 1941, when there were 14,891 persons on the job (HOP [1942]b:214). The policy adopted

⁹ The "total construction costs," which seem to have included at least equipment, materials, and labor, was \$17,156,692.22. Total overhead came to \$7,771,526.70. Other expenses totaled \$993,256.77. The grand total for the plant was \$25,921,475.69 (HOP [1942]b:543).

nationwide by the War Department in hiring personnel for these projects was to "adhere strictly to local labor practices, to pay wage rates prevailing in the vicinity of the project, and to hire local labor insofar as possible" (HOP [1942]b:21). The War Department estimated that most of the labor came from within a 50-mile radius, which would include Louisville, Kentucky, and its environs, and WHMS estimated the balance, about 40 percent, were from Indiana (HOP [1942]b:21). It should be noted that other sources contradict these official statements. This will be discussed in more detail in the Social History section which deals with employment.

The question of union vs. nonunion at the site was "the only labor difficulty of any magnitude" (HOP [1942]b:21). On February 13, 1941, the Louisville unions made it known that they would only furnish workers on a closed shop basis. The next day tradesmen associated with the Louisville Building and Construction Trades Council picketed outside the Louisville offices of WHMS. To solve the problem, representatives of the U. S. Department of Labor, WHMS, and representatives of several local chapters held a conference February 21, 1941, where the contractor agreed to preferential hiring of laborers and mechanics. "The contractor would employ union men as long as they were available, and thereafter additional men could be secured from any other source. It was further agreed that administrative, supervisory, and clerical personnel could be secured after direct negotiations were carried on between the contractor and individual applicants" (HOP [1942]b:21).

There was only one work stoppage during the entire construction phase, coming just days before the first charges were loaded. On August 26, 1941, 12 men protested when a truck driver was let go for incompetency. Work was delayed, but for only 45 minutes, the men agreeing to finish the shift. At the end of their shift a meeting was held between the subcontractor concerned and representatives of the Truck Drivers' Union, where it was agreed that the subcontractor would have the final say in such matters (HOP [1942]b:21).

Throughout the summer of 1941, administrative personnel turned their eyes to the Bag Manufacturing Building as it became the key to being able to say the plant began operations on schedule. They watched as work progressed rapidly during July and August, the only problem being one of how to fasten conduit from the roof. The building "was completed in September, 1941, enabling production to start on schedule" (HOP n.d.b:11-12).

Operations

The first contract for the operation of HOP was signed with the Goodyear Engineering Corporation, an Indiana subsidiary of the Goodyear Tire & Rubber Company of Akron, Ohio, that was incorporated specifically to operate the facility. The contract, W-ORD-498, was signed on December 31, 1940, and it awarded Goodyear the operations for one year, extendable to two years from the time all propellant lines were running if the War Department desired (HOP [1942]c:69).

Although contracts for plants where explosives were manufactured for the most part went to companies with experience in that type of production, contracts for bag and shell loading operations went to enterprises with a variety of manufacturing experience. The use of inexperienced, nonmilitary contractors, including such unlikely companies as Coca Cola, Quaker Oats, and Eastman Kodak, to operate these massive munitions complexes was due in part to the managerial expertise they could bring to such undertakings. It was for that reason that the Ordnance Department approached Goodyear Tire & Rubber Company with a request that they manage one of the GOCO facilities.

The Goodyear Tire & Rubber Company

It is said that the Goodyear Tire & Rubber Company had its beginning in a chance meeting between founder Frank A. Seiberling and Ohio businessman H. C. Nellis. Prior to that meeting, during the latter decades of the nineteenth century, the Seiberling family had been involved in several businesses in Akron, Ohio, including flour milling, the production of oatmeal, banking, real estate, and the manufacture of strawboard, mowers, reapers, and rubber. But the decades spent building up these ventures came to a quick end as many of the family holdings fell victim to the depression of the 1890s. In 1898, Seiberling visited Chicago while taking care of the liquidation of one of his family's businesses, and it was there he ran into Nellis who, like the Seiberling family, was divesting himself of unprofitable holdings. One of these was a strawboard plant that had lain idle for four years. When Nellis mentioned the plant was for sale at \$50,000, about a third of what Nellis had invested in it, Seiberling told him he would be lucky to get half that. Within a few minutes Nellis lowered the price to \$13,500 and Seiberling bought it, but without any clear idea of what he might do with a power plant and two dilapidated buildings set on a seven-acre lot.

Seiberling was vaguely familiar with rubber production, having been involved with the Akron India Rubber Company, a family business that had been sold the year before. On the advice of the rest of his family, he decided to go into the rubber business and named his new venture after Charles Goodyear, considered the founder of the commercial rubber industry because he had developed the process for the hot vulcanization of rubber in 1839. The plant began operations on November 21, 1898.

Only 18 years after this modest beginning, Goodyear was the largest tire producer in the world, and "by 1920, an original investment of \$10,000 in Seiberling's organization would have been worth \$1 million" (O'Reilly 1983:9). But to get to that pinnacle, Goodyear had to wage a battle against heavy competition and restrictive patents. The company began producing carriage tires without a patent which, in spite of healthy sales figures, "gave Goodyear only shallow prosperity, as all profits from the sale of carriage tires had to be placed in escrow" (O'Reilly 1983:15). It was primarily the sale of bicycle tires that provided Goodyear with its early working capital. The situation changed considerably after a federal court of appeals ruled Goodyear was not guilty of patent rights infringement in May 1902 and released all the funds in escrow. With that, Goodyear began construction on a new factory four times the size of the original.

Goodyear then concentrated its efforts toward supplying the booming automobile industry of the early 1900s. The development of longer wearing tires and aggressive sales tactics gave the company a 36 percent share of the original equipment market with auto manufacturers in 1910. By the eve of World War I, the only company in the rubber industry to top Goodyear in terms of total sales volume was U.S. Rubber. But the recession that began in 1920 devastated the company, very nearly causing it to fold in spite of two decades of strong showings in the industry. The subsequent reorganization necessitated by the company's financial troubles forced founder F. A. Seiberling to step down as president, ending what the company calls its "Seiberling era," but left in place the "Old Guard" and the ambition Seiberling had instilled in that small group of early management personnel.

Hardened by the reorganization and supported by diversification and well-planned expansion during the 1920s, Goodyear fared the depression of the 1930s well, even though sales plummeted. During the lean times, it acquired struggling enterprises, and growing foreign auto markets encouraged the company to set up factories in other countries. It was during the Depression that Goodyear christened the first of its trademark dirigibles, the Akron, completed in 1931. By the time events in Europe pointed decidedly toward international involvement and World War II, Goodyear had a "hold on global leadership in the tire and rubber industry, had gained solid manufacturing footholds in burgeoning foreign markets, and was still led by many of those who had guided it to the top" (O'Reilly 1983:81). It was likely the lengthy and diverse experience of those who had guided it to the top that most influenced Ordinance's decision to have this company run one of its earliest bag manufacturing plants.

A Top GOCO Producer Goes Into Operation

Some months before operations began, key Goodyear employees were sent to Picatinny Arsenal (Dover, New Jersey) and to Curtis Bay Ordnance Depot (Curtis Bay, Maryland) for training, accompanied by government powder and explosives inspectors. Operations employees began receiving training in August 1941, and the first training school was set up in one of the inert storage warehouses (the school was later moved to the bag loading building). Even the first training school had a complete set of equipment--printing presses, sewing machines, and trial loading booths. The trainees made and loaded bags to production specifications, using corn, however, instead of powder, giving the training classes the nickname "corn school" (HOP [1942]c:69).

Production officially began on September 2, the day after Labor Day, when Propellant Charge Line Eight went into operation. Three more lines were only awaiting the arrival of copper chutes and hoppers, which were expected before the end of the month (HOP [1942]a:September 2, 1941). On the first day of operation, 52 charges for the 105-mm howitzer were produced. Production gradually increased, and by September 29 daily production had already exceeded designed capacity. But even though this line alone was capable of loading the 70,000 charges the plant was scheduled to produce in September, it fell short by over 40,000 charges.

There were problems in the bag manufacturing area as well. Originally, the layout and operations were patterned on those in use at Picatinny Arsenal. Apparently the inspection procedure was not compatible with this layout and resulted in inefficiencies. The other problem indicates training for the bag manufacturing employees was not as thorough as could be desired, probably because of the number of new employees and time constraints involved. The managers complained that "employees of this department lacked experience in operating power sewing machines, and many had not previously worked in an industrial plant" (HOP [1942]c:72-74).

The confusion involved in the start up of the bag loading plant gives some insight into the massive effort involved in coordinating production during the industrial mobilization phase, as well as the height of the Ordnance Department's expectations. The first production schedule, dated April 16, 1941, required that 400,000 propelling charges for the 75-mm howitzer be loaded during July 1941 (this would have required production to start just three months after the first stakes were driven for construction). But as the plant would not be sufficiently complete to undertake this work by July and personnel would not have been trained by that time, a new schedule was issued a few days later that called for 66,000 charges for the 75-mm howitzer to be loaded in September 1941 and 100,000 charges for the 105-mm howitzer in October 1941. However, management personnel at IOW #1 said that facility would not be able to make smokeless powder for the 75-mm howitzer available to HOP in September, so the schedule was again changed to cover only the 105-mm howitzers (HOP [1942]c:69).

By the beginning of December construction had been completed on the eight propellant charge lines, all were in production, and the operating schedules of the Chief of Ordnance were met. By the end of the year all the lines were operating one shift daily, six days a week (HOP [1942]c:76).

As explained in the previous section concerning production at IOW #1, that facility produced two kinds of powder, both of which were used in the assembly of charges. Most of the powder was single-base smokeless powder, the propellant that moved the projectile through space. Black powder, much more volatile, was used for the igniter that set off the smokeless powder, like the percussion cap of a shotgun shell.

The unit called the "charge" is a stack of as many as seven bags of powder fastened together. The individual bags are called "increments," and are marked according to their order in the stack (Zone One, Zone Two, etc.). The charges can be fixed or semi-fixed, which refers to the way they are fastened together. In semi-fixed charges used in the smaller howitzers, the increments are tied together in their outer wrapping, allowing gunners the option of removing increments for short range firing when the impact force of a full charge was

not needed. The fixed charges were for the big guns, and as the name implies, the individual increments could not be removed from the outer wrapping.

Charges for 155-mm and smaller howitzers were ignited by the primer in the Zone One increment, which fit into the doughnut-shaped Zone Two increment. The charges of the larger guns were set off by an igniter, which used black powder. These were flatter than other increments and were quilted to distribute the powder evenly. They were sometimes packed in the charges at the factory, sometimes shipped separately and placed in the chamber of the gun in the field.

Raw silk (which resembles soft burlap) is the preferable material for the bags since, unlike cotton, when it is burning it creates no embers that could prematurely set off the next increment. This is less important in smaller charges since these are loaded into cartridges before firing, so cotton could be fairly easily be substituted. Substitution was less desirable in the larger charges, and silk was a must for the igniters (Hugh 1949:537-539).

Several different types of charges were produced at HOP, but the processes involved were fairly similar. The following description relates to the process for loading the 105-mm howitzer charge, one of the more important products at HOP, accounting for nearly half of total production during the war. The load, assembly and pack process at HOP involved two distinct operations, the first being bag manufacturing. The building housing most of this operation was the largest of three connected structures, the others being the combination cafeteria and change house to the west, and the dye and wash house to the south. The latter is where the fabric would first be brought into the bag manufacturing process. There the fabric was washed, and dyed if need be. The igniter end of a charge was always red so it could be quickly identified in the field. Short range charges, also used for training, were bagged in green cloth. After being run through tumble dryers the fabric was moved to the main building where it was stored until needed.

Fabric taken from storage in the main bag manufacturing building was sent in two directions (Figures 32 and 33). Future end pieces and tying straps went to the long lay-up and cut tables. The end pieces were cut by punch presses from stacked cloth about 20 layers thick. Those to be printed were then sent to the press, inspected, and taken to the first two sewing assemblies, where the pad for the igniter was added. These then joined the pieces of the body at an inspection and collection point. The body pieces had first been cut into long strips by a slitter, folded, and sewn into long tubes, then cut to the length required for the charge being made. They were then inspected and sent to join the end pieces and straps at the collection point. Last, the ends were sewn on, straps were added to some bags, then the entire assembly was inspected one last time before it was ready for the load line.

The second operation is the load, assembly, and pack process. The components that went into most charges were loaded on two different lines, one for the black powder igniter and one for the other increments, which used smokeless powder. The two processes are essentially the same so only the loading of the smokeless powder will be followed.

Smokeless powder was first brought from storage igloos and delivered to one of the line's two service magazines (Figure 34). The powder stored in these magazines was limited to the amount that could be loaded during an average day of production. The powder was transferred to the loading buildings (building numbers 3001 through 3017) over covered concrete walks and taken by elevator to the second floor, where it was placed in non-sparking copper hoppers that would deliver it to the booths below (BTI 1984:40). For the 105-mm howitzer charge, booths three and five were used (Figure 35). Zone six and seven increments were loaded in booth three, and zone five increments, the base increment for this charge, were loaded in booth five. The powder was fed from the hopper by gravity into a powder tub (Figure 36). The specified amount for the increment was then weighed, placed in the bag, and sewn shut (Figure 37). The increment was then passed to the center aisle through a transfer chute, inspected, and passed to the assembly and packing section of the building through another transfer chute. (The purpose of the transfer chute was to keep the amount

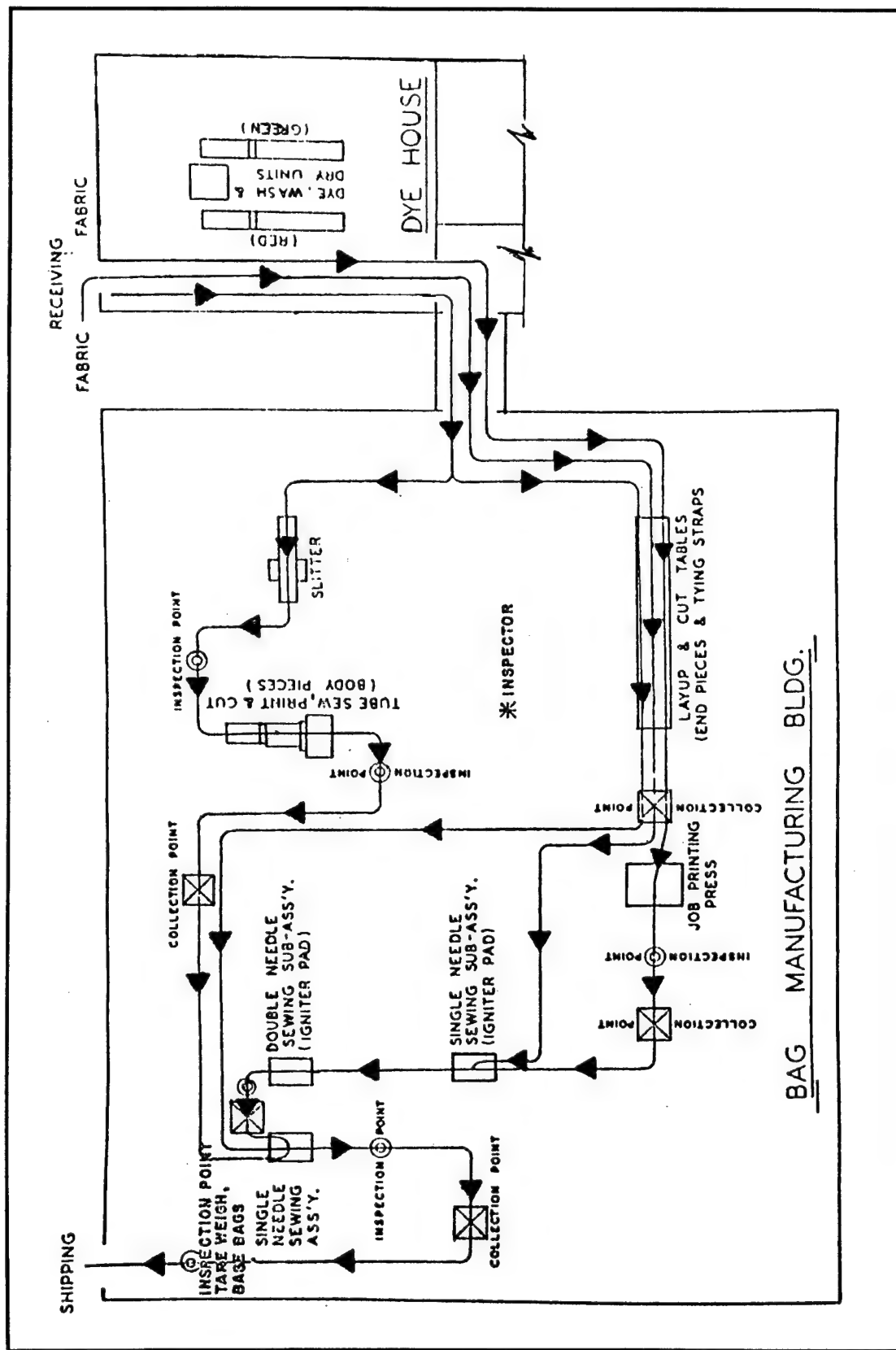


Figure 32. Flow of material through the Bag Manufacturing Building (Building 1001) for the manufacture of 105 mm howitzer charges.

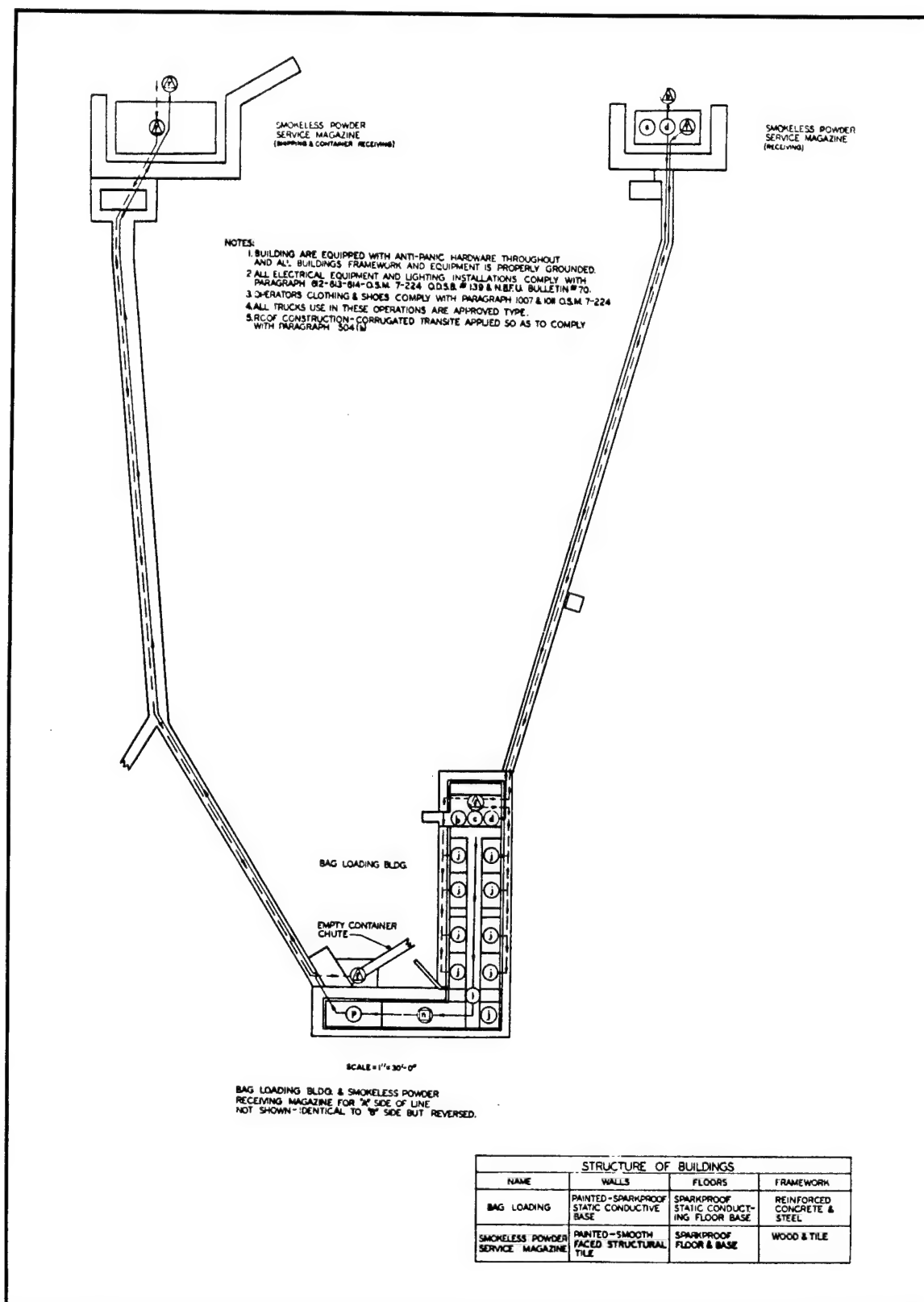


Figure 34. LAP building group, "A" side, Hoosier Ordnance Plant (INAAP Drawing 2636-497).

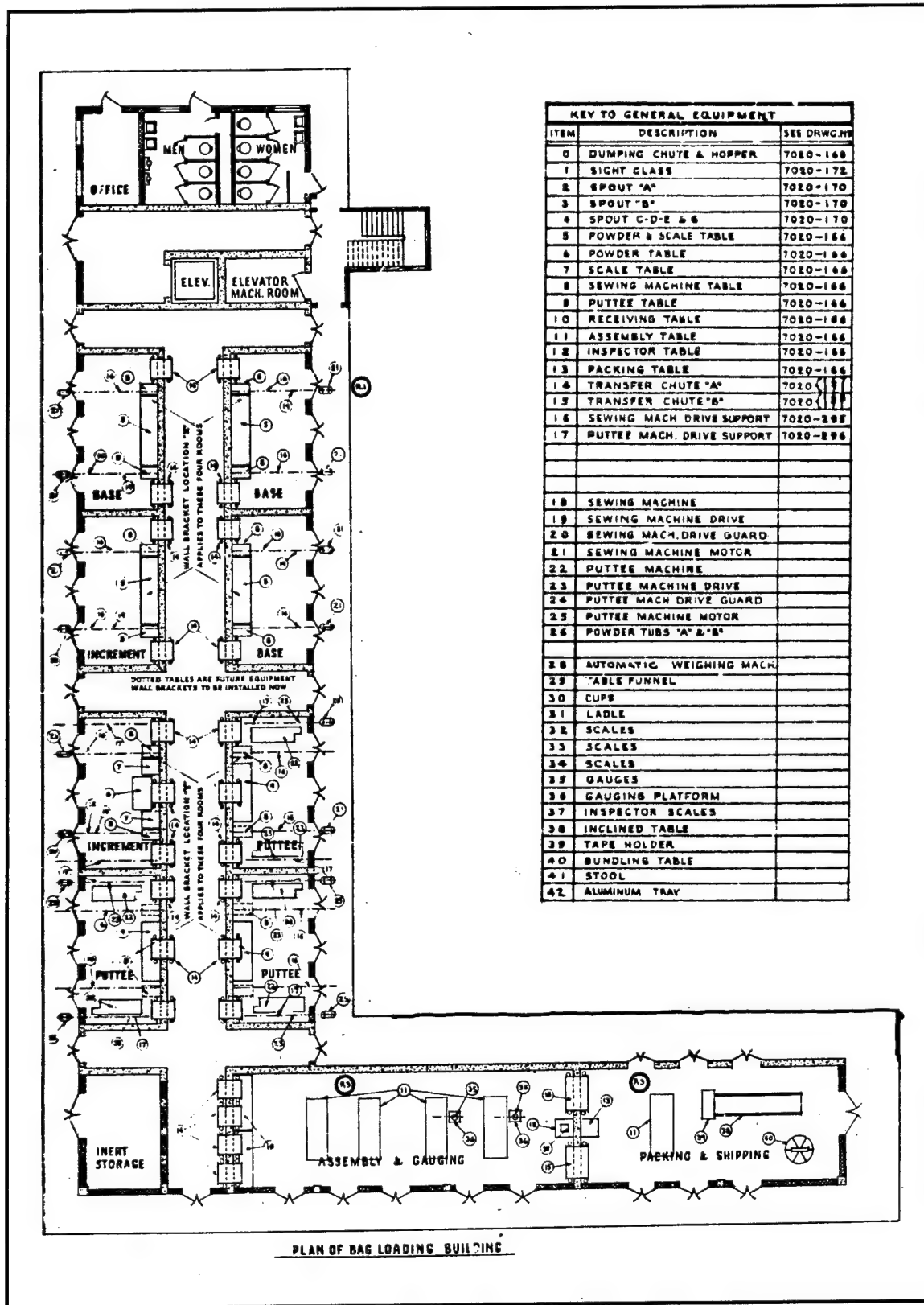


Figure 35. Floor plan of the LAP buildings (buildings 3001-3017, excluding 3010), Hoosier Ordnance Plant (INAAP Drawing 7020-165).

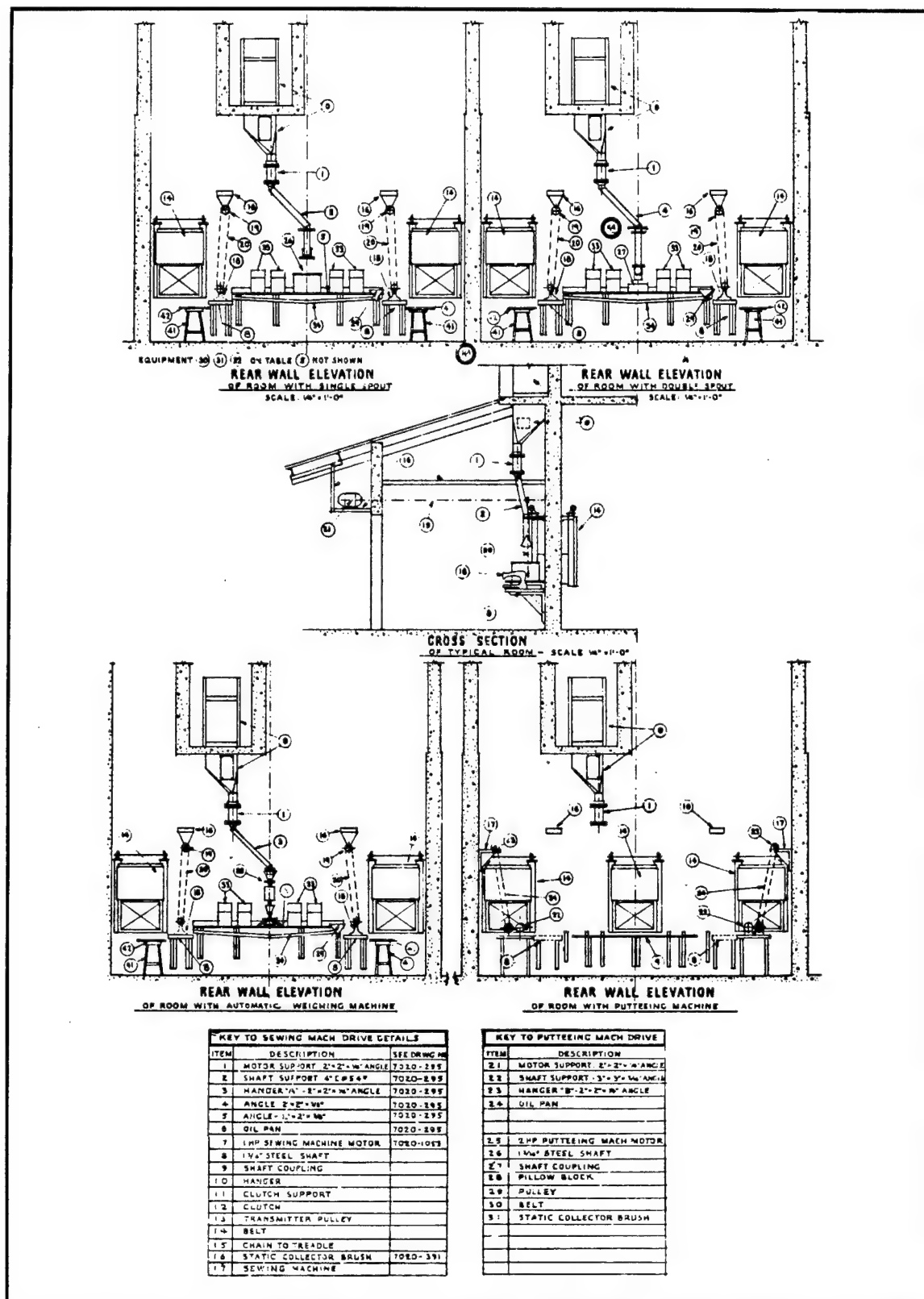


Figure 36. Arrangement of equipment in the LAP building loading booths, Hoosier Ordnance Plant (INAAP Drawing 7020-165).

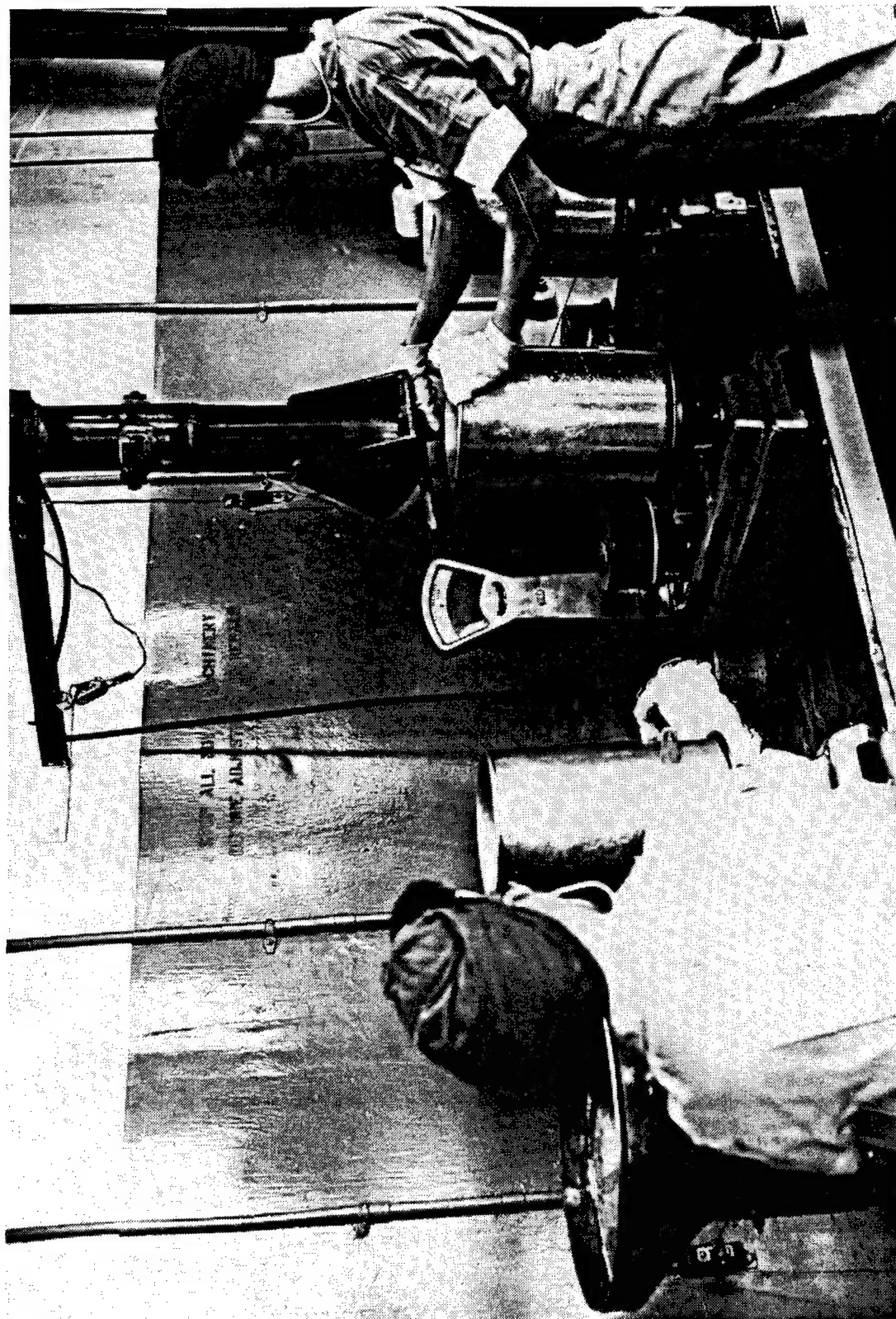


Figure 37. Operators weighing powder, placing the powder into increment bags, then sewing the bags shut in a loading booth, LAP Building, Hoosier Ordnance Plant (photo courtesy INAAP).

of airborne powder circulating through the building at a minimum.) The increments would then be stacked in order, placed in the outer charge bag, and inspected once more to make sure the diameter and length were within tolerance (Figure 38). After passing through another transfer chute they were then packed in shipping containers and taken to the service magazine opposite the one where the bulk powder was stored. From there they were sent to storage or to boxcars for shipping.

HOP had eight of these propellant loading lines, each with "A" and "B" side LAP buildings, as well as four igniter loading lines, and black powder screening and drying facilities. The charges produced there ranged in weight from two thousandths of a pound to 896 pounds (INAAP [1967]:7).

After all eight loading lines were up and running, which was December 1941, production schedules for HOP were upgraded, making it necessary to operate two shifts, six days a week on all eight lines beginning in January. But initial estimates of how large a labor force would be needed to keep pace with the schedules handed down by the Ordnance Department proved to be excessive. As new employees learned to handle their jobs with greater finesse, efficiency increased to the point that production was far in excess of the schedules, and was even draining their powder suppliers. This steady increase in efficiency characterized production throughout the war, a point of pride for Goodyear.

The man hours per thousand charges averaged 500 in 1941, dropped to 330 in 1942, to 175 in 1943, to 120 in 1944, and was hitting 100 hours per thousand charges and better when the war ended. Without this increased production it would have been necessary to build a second loading plant as large as [the] Charlestown [plant] (Hugh 1949:548).

Even as early as the end of 1942 Goodyear had initiated a good many improvements to the process. The Gang Punch Machine was designed to cut up to 30 lacing holes at once in charge body bags which were laced up around the increments. The Circular Punch Drill similarly mechanized the cutting of individual holes around the top of laced charges. A new method of using dies and a mechanical punch to make 1.27-cm (0.5 in) holes in the centers of Zone 2 increments replaced the previous time-consuming and tiring method that was done entirely by hand using a hammer and punch. A cylinder extracting machine for stacked charges resulted in a more uniform column, less damage to equipment, less physical strain for the operator, and greater speed (HOP [1942]c:118-134).

Production increased so fast at HOP that on March 9, 1942, the Ordnance Department advised them that they would have to keep their production levels at no more than 20 percent over scheduled amounts. Seven days later the plant began cutting back its labor force to keep within these limits, laying off employees who had just been hired. Just prior to this, employment had reached its first high of 7,526 persons. By the end of the month the figure had fallen by nearly a third to 5,148 (Figure 39). The schedules handed down from Ordnance continued to increase, however, and by the middle of September the labor force had grown once again to nearly 6,500 (INAAP [1963]:17).

In September 1943 the plant administration was notified that its production schedule would soon be increased significantly. Goodyear estimated that it would need as many as 3,000 new employees, and approximately 80 percent were expected to be women. Thereafter, until near the end of the war, employment gradually increased, hitting its peak of 8,902 persons in March 1945, just after the plant turned out its hundred millionth charge.

Further technological developments had been instituted at the facility by the end of 1944. A technique called "all-over Printing" permitted the use of high-speed rotary presses rather than plate presses to print the cloth for increment and charge body bags. And square "pancake" bags replaced circular bags and allowed greater automation to be used. This substitution could be made with most of the semi-fixed charges, and it was a significant improvement.

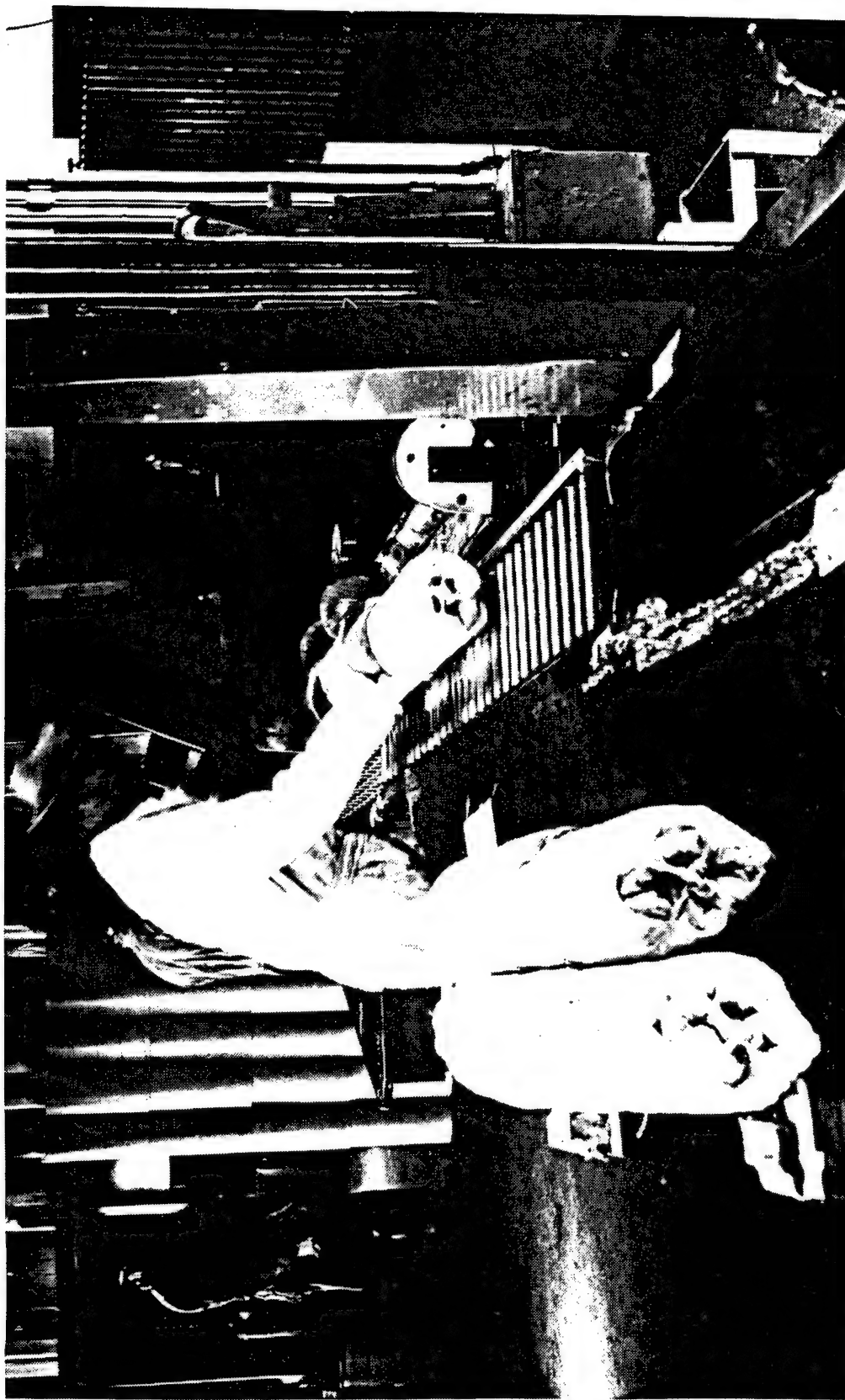


Figure 38. Using a gauge to check the length of a charge in the LAP Building, Hoosier Ordnance Plant (photo courtesy INAAP).

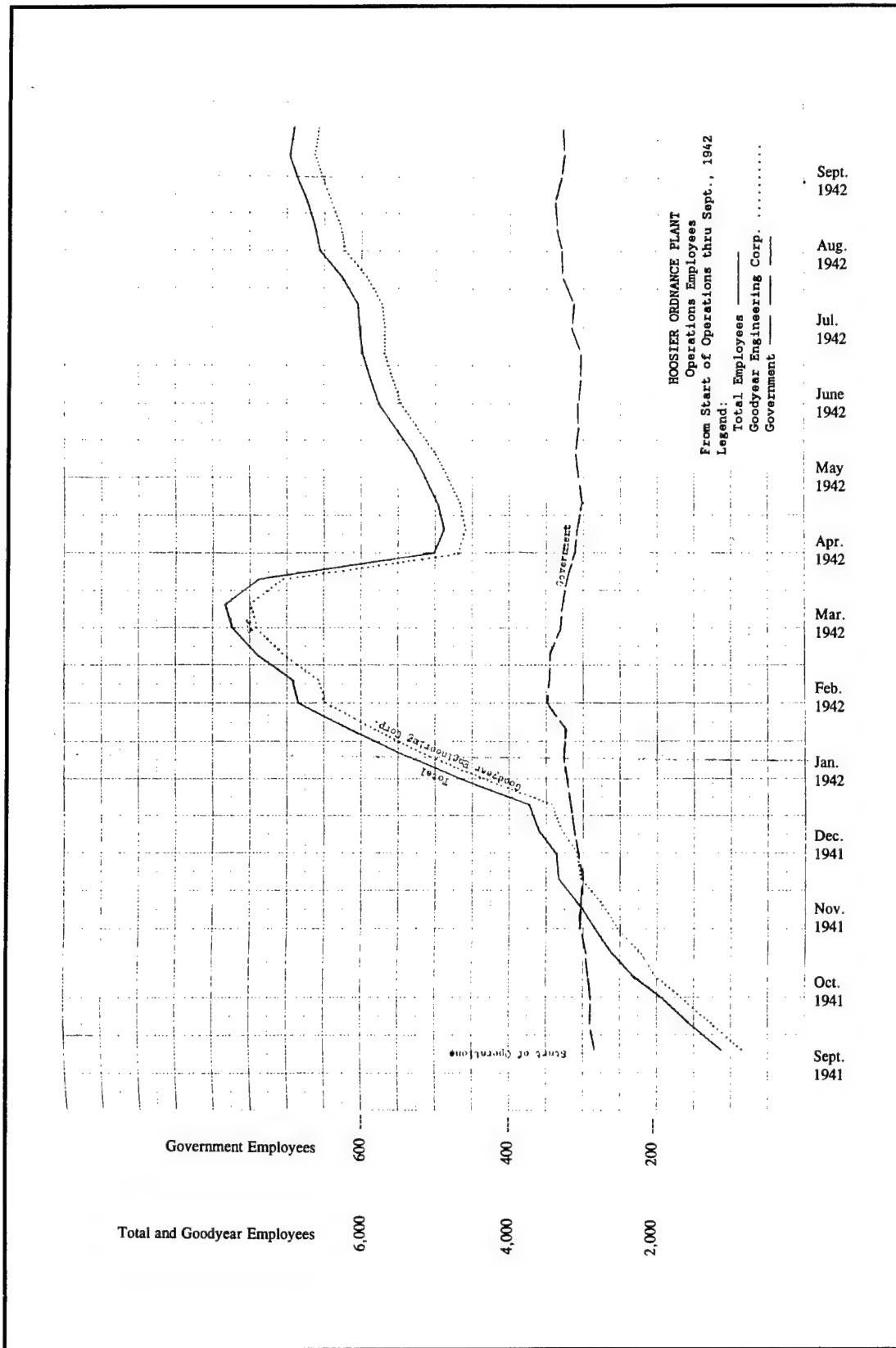


Figure 39. Goodyear and Ordnance Department employee levels, beginning of operations through September 1942 (HOP [1942]c).

This change in design reduces manpower requirements by 275 people based upon [the] January, 1945 schedule and saves approximately in addition 140,000 square yards of Grade 'C' cotton cartridge cloth per month. This is a change which is available to the entire bag loading industry and is calculated to represent a saving of approximately \$2,000 per day at this plant. The material saving is traceable to the almost 100% utilization of the material, avoiding the scrap between tangent circles . . . The two innovations described above enabled this plant to solve its manpower requirements for the end of the last quarter of 1944 and the beginning of 1945 thereby making it possible to produce all War Department's schedules 100% (HOP [1944]b:16).

By June 1945 the end of the war was in sight and curtailments in production forced Goodyear to again lay off about a third of its work force. When the end did come it brought a sudden change at HOP. On V-J Day, August 14, 1945, "the Contractor terminated 500 production workers. Official termination of Contract W-ORD-498 was effective as of 15 August 1945, and production ceased on 18 August." Two weeks later the plant was declared a standby facility (HOP [1943]a:16-18; INAAP [1967]:7).

By the end of this first era of operations, HOP had produced 116,181,170 propellant and black powder charges, nearly half of which were for the 105-mm howitzer. They had packed more than 239,949,110 kg (529,000,000 lbs) of smokeless and black powder and had used 42,642,630 sq m (51,000,000 sq yd) of fabric, enough that a meter-wide strip would almost reach around the earth at the equator (HOP [1945]:1-2). These figures are not just average--HOP was the top producer among GOCO bag loading plants during World War II. The government took over the facility on December 17, 1945.

The Indiana Ordnance Works Plant 2

Change Order Number 18 to Contract Number W-ORD-458, which authorized Du Pont to build a rocket propellant plant, was issued October 31, 1944, and construction began that December. The plant was designed to have three lines producing double-base rocket powder, the basic operations being the manufacture of nitroglycerine, which was then mixed with nitrocellulose to form a paste and shaped for use as propellant. The local media portrayed the plant as a producer of "robomb powder," which would be used in "the Army's newly designed experimental robot bomb," similar to the V-1 bomb the Germans had developed (*Louisville Courier-Journal* [LC-J] 1944a, 1944b).

This addition was to cost \$28,000,000 and employ 6,500 during construction and 5,000 during production. But it came at a time when locating such numbers of employees was extremely difficult. "Last week, when a call was issued for 200 construction workers, only seven construction laborers showed up. There were four labor foremen to supervise the work of seven laborers" (IOW [1945]a:December 25, 1944 and attached newspaper clipping from the that day's issue of the *Louisville Courier-Journal*, no page).

Locating construction workers was not the only problem IOW #2 faced. That winter and spring were subject to excessive rainfall. Construction materials and equipment were even more difficult to locate than they had been during the construction of HOP. Nevertheless, seven months into the project the work was only one percent behind schedule. And by May 20, 1945, "one thousand German prisoners of war had been moved in to augment the labor force," but it is doubtful that the POWs contributed directly to construction (INAAP [1963]:30).

Supervisory personnel hired for operations were sent to Sunflower Ordnance Works, Kansas, for training. They returned in the middle of May, and on July 20 began processing solventless extruded double-base propellant powder, using paste shipped to the plant a month before (Indiana Arsenal [1955]:1; IOW [1945]b:May 8).

But at 5:45 pm on August 11, 1945, orders were received to cancel all construction work at the plant, the same message all Ordnance plants received. Construction officially ceased on Monday, August 13, and in less than two weeks 15,328 construction employees had been terminated and all the prisoners of war shipped out. Operations ceased on the last day of August, after only about five weeks. In all, 132,766 kg (292,700 lbs) of double-base rocket powder was processed at the facility.

In February 1946, after being decontaminated, IOW #2 was turned over to the government. More than 2,023 ha (5,000 ac) of the 3,318 ha (8,200 ac) on which the plant was situated were declared excess and sold. Only the magazine area was kept, to be used for the storage of propellant. The government handed over the surveillance and storage responsibilities to Goodyear in September 1954 (INAAP [1963]:30-31). Liberty Powder Defense Corporation took over these responsibilities in November 1959. All the material stored in the magazine area was moved to IOW #1 and HOP units in the early 1960s, when many buildings and much of the equipment were shipped to other government plants or sold as surplus. An additional 648 ha (1,600 ac) were declared surplus and sold in the mid-1960s (INAAP [1963]:31, [1967]:13-14). A black powder plant was later built on what remained of the old IOW #2.

SOCIAL HISTORY

Land Acquisition

"It is still a deep, dark secret."

This comment by an anonymous farmer is the beginning of an article in the *Jeffersonville Evening News* (1940) in early 1940 that dealt with the sense of mystery that pervaded Charlestown regarding the cryptic C. V. Atwell, who had visited the area to buy land options for Du Pont at the end of 1939. "He made only veiled statements as to a 'something' of vast proportions which may locate here." Such statements alluding to a project of grand proportions combined with rumors about "big prices" being offered for farmland and talk about the "Dawn of the Day of Nylon," an article by Don Wharton that had recently been published in *Reader's Digest* (February 1940:26-29) to create an air of sometimes optimistic sometimes worried uncertainty there near the end of the Depression. As February wore on and some of the options began to expire, the citizens of Charlestown felt the secret darken more. There was a growing feeling that "the anticipated boom . . . may prove a boomerang" (*Clark County Journal* 1940).

At that time Charlestown was a sleepy little country town with a population of 939, largely composed of retired farmers. According to Julius Hock, who had moved to the town at age two (ca. 1913), it was a place where kids took off their shoes and walked home barefoot in warm weather along country roads (the only paved road then was Indiana Road 62), and where everyone had walked up and down the streets beating pans on Armistice Day (Hock, interview 1994). Another resident, Christine Richey, added that it was a close-knit community where everyone knew everyone else (Richey, interview 1994). The Baltimore & Ohio Railroad tracks skirted the east side of town, but the trains only whistled as they went by. Charlestown's business district was no more than a bank, a post office, a few stores, several filling stations, and a tavern. Harry Payne, a barber in the town, said the streets and buildings were "pretty well run down" when he first arrived in 1933 (Payne and Payne, interview 1994). The actual center of business for the area lay 19 km (12 mi) to the south, in what is still called the Falls Cities area: Jeffersonville and New Albany on the Indiana side of the Ohio River, Louisville on the Kentucky side. Those that were not retired likely commuted to one of those cities to work.

Many of the retired farmers would gather around coffee and breakfast of mornings in Reedy Haymaker's restaurant, making it fertile ground for the sowing and encouraging of rumors. That was where Christine Richey was when she first heard that a big change might be on its way to Charlestown--"everybody was

buzzing about it.” But, she adds, not everyone placed a great deal of stock in the gossip that emanated from Reedy’s place (Richey, interview 1994).

The mystery ended when the *Louisville Courier-Journal* announced in its headlines that the War Department had chosen Charlestown as the sight of a munitions factory “destined to be the world’s largest” smokeless powder plant (Steeg n.d.:1), and that E. I. du Pont de Nemours & Company had been chosen to build and operate the huge facility. The townspeople were excited, but at the same time they were bewildered, wondering what such a venture would mean for the area. The first thing it meant was the exchange of a lot of Ohio River valley property.

The responses to the land acquisitions for IOW #1, which initially involved the transfer of 70 tracts of land (IOW n.d.:1-1), were mixed. One source relates that “in those Depression days, land wasn’t selling for much, crops were hard to raise, and no one wanted the stuff anyway. A chance to sell the place was a godsend” (McManus 1979:2). Some did accept Du Pont’s first offers, but others complained bitterly, contesting what they saw as forced eviction from land that had been in the family for generations (Myers 1992:11). Many of those with such deep roots in the area were extremely reluctant to sell. Others complained at having to give up “prime farming land” on which they “made a good living” (Richey, interview 1994). This seems to have been true, but within limits, as some of the land that fit that description “had ceased to yield a reluctant living and had been abandoned between World Wars I and II” (Stoner and Field [1943]:7). And others may have wanted to hold onto land in anticipation of selling for more money, swayed by newspaper reports of skyrocketing real estate prices. Early property sales both within Charlestown and without were said to be three times what they would have been a year earlier; at the end of July 1940, Colonel Hardy speculated that values in town had risen a thousand percent.

The people who wanted more compensation for having to give up their land banded together to push for greater valuation of their properties. The cases of such long-time residents as the Lentzes and Botorffs were enhanced by familial attachments to properties that extended back several generations. One jury awarded the owners of a group of 13 tracts an amount totaling \$59,000 over government appraisals. This included a tract belonging to the family of Moses Lewman, who had migrated to Clark County in 1819. However, this total was still \$50,000 below that of independent appraisers appointed by the court at the beginning of the suit (Anonymous n.d.b).

Since the acquisitions at IOW #1 were becoming a problematic affair, and more expensive than had been expected, the purchase of property was approached differently at HOP. Originally the data for the facility indicated 3,000 ac would be needed. When the Soil Conservation Service conducted its appraisals, it was requested to do so keeping in mind that the purchase would likely be settled through condemnation proceedings at a later date. It seems, in other words, that the War Department expected to have to go to court to reach settlements for many tracts no matter what was originally offered, so offers should be kept low. It was estimated that some properties purchased for the construction of HOP brought only about half what they would have if they had been bought during the first round of acquisitions (*Charlestown Courier [CC]* 1941a:1).

The 1,214 ha (3,000 ac) covered 34 tracts, and only 16 of the initial offers were accepted, giving the government title to less than half the land needed for the plant (596.5 ha; 1,474 ac). The remaining tracts were reappraised by court appointed appraisers, but the new prices were also unacceptable to the owners. Condemnation proceedings were begun in January 1941, and possession was authorized by February 13, final prices to be determined later by jury trial. However, by this time revised estimates showed more land would be needed, an additional 356.5 ha (881 ac) were surveyed, and the process was begun again, with a similar unsatisfactory conclusion. And begun again as estimates were revised further upwards and an additional 315.5 ha (780 ac) were required (HOP [1942]b:11-12).

That well over half the tracts on which IOW #1 and HOP are located were acquired by Declaration of Taking rather than outright purchases shows the extent to which people felt government offers were not sufficient. Table 3 lists a sample of the acquisition record from HOP and awards which were paid.¹⁰ The price per acre of tract 120, the only piece of property not acquired by Declaration of Taking in this sample, was \$127.42. That is significantly above the appraisals of the two other tracts in this sample of comparable size, tracts 100 and 110, originally appraised at \$89.26 and \$99.46 per acre, respectively. The final price per acre for each of these was \$123.73 and \$172.04.

Table 3
Appraisals and Purchase Prices for Select Tracts at HOP

Tract Number	Landowner's Name	Acreage	Method Acquired*	Original Appraisal	Final Price
100	J. B. Lewman	161.04	DT	14,375	19,925
110	L. V. Prather	115.67	DT	11,505	19,900
120	W. L. Jacobs	85.74	P	10,925	10,925
130	Ida Lewman	28.00	DT	560	750
140	R. A. White	0.52	DT	300	750
150	Southern Realty and Loan	0.30	DT	150	245
160	Alice Horan	0.46	DT	1,350	2,350
170	T. S. Ransdel	0.30	DT	207	300
180	E. C. Reynolds	0.25	DT	788	1,250
190	M. S. Bruner	31.00	DT	4,200	6,850
200	J. H. Morris	8.62	DT	2,868	3,500

*P = purchase, DT = Declaration of Taking.

Source: U.S. Army Corps of Engineers, Louisville, Kentucky office, Tract Register for Indiana Arsenal.

Although some landowners remained unhappy about the settlements, the general impression seems to have been that prices paid were at least adequate for the area. "There were a lot of people that felt they were getting what they wanted for their property and wanted to go some place else" (Hock, interview 1994). "They paid enormous prices [for the tracts] . . . in order to get possession and to keep these people happy." The amount was more than enough to buy new land. "They weren't really hurt financially, it was just an emotional thing" (Payne and Payne, interview 1994). One owner who sold land to make way for the plant summed up the two sides in a letter to a local newspaper--"Although we were paid well for our acreage, still it isn't so easy to stand by and see the familiar old oak, the lilacs, hollyhocks and roses around the door trampled under foot to make way for the giant smokestacks that rose almost overnight" (*Louisville Times [LT]* 1940).

¹⁰ The land for IOW #1 was purchased by Du Pont, then sold to the government as one tract. Records related to the purchase of individual tracts may be housed in the Hagley Museum and Library, Wilmington, Delaware, where the Du Pont archives are housed.

There was little land available on the Indiana side of the Ohio River for the dispossessed to purchase with the money they were paid, enormous amounts or not. Some of those who wanted to continue farming moved to the other side of the river and bought land in Kentucky. These included Lucille Prather, who sold tracts 104 and 110 then bought a farm in Bloomfield, Kentucky; and Clifton Crum, who sold the 96 ac of Tract 117 and bought a 100-ac farm near the same Bloomfield. William Carr Lentz, the most successful farmer in the area, moved to a farm near Columbus, Indiana (Anonymous n.d.c). Many others took the opportunity to move into the city, buying places in New Albany, Jeffersonville, and Louisville. One woman bought a lot in Charlestown and set up a trailer camp there, which in 1941 was earning her \$180.00 a month (*Indianapolis Star [IS]* 1941:n.p.).

Real property records show many of the structures acquired with the land were sold later. For example, Tract 110, which belonged to Maurice A. and Lucille V. Prather, a prominent area family, contained a two-story frame house with six rooms on each floor and eight outbuildings, including two barns. When the Prathers vacated the property they were allowed to remove all but the house and one barn, which was blown over in a windstorm two months later. The remains of the barn were then given to the Prathers in exchange for clearing the site. WHMS stored salvage material in the house for about five months in the latter half of 1941, after which it was sold for \$80.00 (Anonymous n.d.d:Tract 110). The Middleton and Eva L. Koons place had a nine-room frame house with basement, 10 outbuildings, and two old brick houses in poor condition. While burning the outbuildings to clear the site, the frame house was accidentally set on fire and also destroyed. The two brick structures were sold in the latter half of 1941 (Anonymous n.d.d:Tract 118).

Along with the land for the HOP facility the government acquired 47 farmhouses, numerous barns and outbuildings, and 35 summer cottages in the south portion of the Longview Beach subdivision. There, and likely at IOW #1, some of these were used by the contractors and subcontractors, others were released to the former landowners or sold. The cemeteries situated on the sites of both plants were left intact and visitation rights were granted to relatives (HOP [1942]b:12).

Boomtown

The War Department was certainly conscious of the enormous impact their decision to locate plants in rural areas would have, even at times calling the project at Charlestown an experiment. Journalists likened Charlestown to a guinea pig. But original plans did not foresee the facility growing to the size it did. What at the beginning was to be a facility with two lines producing smokeless powder grew to first four lines, then six. Then the bag loading plant was added to the south side. These plans had changed over a matter of just a few months. And toward the end of the war the rocket propellant facility was added, which, had it been finished would have once again substantially increased the impact of this "experiment."

The effects of the impact could have been disheartening, perhaps even tragic. There was speculation that Charlestown could become a ghost town after the war, unable to support its short-time war-era growth spurt. Industry and developers who, had they located there could have helped ease a post-war transition, shied away because the government said the plant would be closed when the war ended. Other people wondered about the increase in crime, about whether the influx of people (which, it was reported, could double the size of the town) would pollute the moral fiber of a close-knit rural community like the one in Charlestown.

It is unlikely government planners thought the impact beyond the capabilities of the people, but it seems just as unlikely they would have thought Charlestown could handle the new situation so well. The town certainly suffered its share of growing pains and the citizens their share of hardship; but on the whole the town and its people came through the war relatively unscathed. To use the jargon of the day, Charlestown was not the site of heavy conflict on the industrial front. At least not for the first four years. There are doubtless several reasons for this, none of which have been explicitly stated by those contacted in the course of this research. They have appeared as part of the aggregate personality of those involved, a personality that has evolved

from the material left by those who wrote about the plants and from discussions with those who worked there. But two possibilities stand out above all else--pride at being in the vanguard of the defense effort, and the enthusiasm borne of being integrated into the Modern Era.

The Setting

Prior to construction at the plants, Clark County had a population of just over 31,000, about 900 of whom resided in Charlestown (Table 4). Those who were not retired or working in the few businesses in town had found employment in the larger cities to the south. There was one hotel, which was full as soon as the first Du Pont and government people arrived, and about 300 homes. The area was said by one writer to be in the doldrums: "The number of telephone subscribers was decreasing, carloadings [*sic*] of grain to be shipped away had dwindled and vanished, and rents for the business buildings had declined to less than that paid for residences in more thriving communities" (Bolly 1940; Stoner and Field [1943]:7).

Table 4
Growth and Decline of the Charlestown Population

Year	Population	Year	Population
1900	915	1940	939
1910	864	1950	4,785
1920	820	1960	5,726
1930	859		

Source: U.S. Census records.

Charlestown was governed by a five-member board of trustees, headed by Dr. C. F. Pangborn, known locally as "Doc." The other members were a school teacher, a filling station operator, and two retired farmers. They met a few times a month, mainly to discuss a sewer system for the town. There were only a few paid employees in Charlestown. The town marshal was in charge of a variety of activities, which even included organizing the local hog farmers when they occasionally collected the garbage; Charlestown had no formal trash or garbage collection, but this system had served adequately enough for many years. And there was the superintendent of the new water plant, who read the meters and oiled the pump. Charlestown also had a justice of the peace, reluctant to fine people because locals were predisposed to believe many men in this position lined their pockets that way. On the county level there was a sheriff, whose work was also a mixed bag of duties until the condemnation proceedings began for the plants, when most of his time went to serving processes.

There had been two inadvertent preparations for the boom--a small water supply plant had been built and construction on a new sewage system and treatment plant was underway. The water plant had been completed in the fall of 1937 and would have been sufficient to handle even a rather large jump in the population under normal conditions. Most homes were tied into the system by 1940, but even as late as the end of the first quarter of 1941, 17 percent of the houses still depended on wells and cisterns. The sewer system was a WPA project. Selling bonds to raise the money for the water treatment plant and then for the sponsor's contribution for the sewage system taxed the town heavily. When Colonel Kelly Lewis first set his bags down at the Hotel Residence in the summer of 1940, the WPA project was moving slowly along.

In the words of Henry Steeg, who soon became intimately involved with the municipal affairs of the town, "what difference did it make if the sewage system was not completed that year--or the next--or possibly the year after that? Charlestown had been getting along very well without one for 132 years" (Steeg n.d.:3).

Probably the greatest threat facing Charlestown was the threat to the physical well being of those who were and would be living there. The possibility of a serious health problem was daunting. Thousands of new workers would bring new diseases to the area and might not have developed as much resistance to dysentery, tuberculosis, and typhoid as the natives had, these being more prevalent in the area than the statewide average. Typhoid cases in Charlestown and its environs were 2.5 times higher than the state average (Field and Stoner 1943:43).

The flood of 1937 had an impact on area health care which benefited Charlestown during the boom years. If the flood had not caused district health departments to be established in the area "the task of organizing and administering the public health services . . . would have been a very trying one" (Stoner and Field [1942]:74). Each district covered three to five counties, and Charlestown was under the jurisdiction of District Health Department Number Three. At the beginning of the boomtown era, there were three nurses in Clark County. One was a state board of health nurse for District Three, one worked for the Clark County Tuberculosis Association, the other for the American Red Cross in Jeffersonville. Two of the more important duties of these nurses were maternity and infant care, including education in how to be better parents. During the first half of the 1940s, 50 to 80 percent of all Clark County babies were born in homes and trailers. The powder plant even made office space available to the nurses and expectant mothers for the delivery of babies (Stoner and Field [1942]:15, 72-74).

The Announcement Comes

All	--WHAT SHALL WE SING?
1st man	--Let's sing of America.
1st woman	--America with it's [<i>sic</i>] quiet villages,
1st man	--its town squares,
2nd man	--its belching smoke stacks,
3rd man	--its shrieking whistles,
2nd woman	--its industry and its farm lands,
All men	--ITS TIMES SQUARE
All women	--AND ITS MAIN STREET
All	--AMERICA, THE LAND OF PIONEERS.
1st man	--First we fought for existence against the primeval forest; then we fought to harness the power of the air, the waters, and the land, to build the greatest industrial centers in the world; now we fight for all that we have conquered before (Anonymous [1942]:7).

This is the end of a play called "Charlestown Infair," which was presented at the school grounds June 4, 1942. That was after the plant was already in operation, but is a fitting way to begin this section. It shows the foundation that underlay the attitudes of the people of Charlestown, how they saw their place in the events happening around them, how they saw themselves fitting into the Modernist era. And a look at the people of Charlestown needs to take this into consideration.

The Depression era provided fertile ground for the dream of a brighter future sown by American Industry both before and during that time. A dream that found its height of expression at the 1939-1940 New York World's Fair. "These buildings are themselves a glimpse into the future, a sort of foretaste of that better world of tomorrow, of which we [the Fair Committee] hope in some part to be the harbingers. We feel that simplicity must be the keynote of a perfectly ordered mechanical civilization" (Whalen 1937:25). This

statement about two focal points of the New York World's Fair reflects the relationship between the mechanical, between industry, and the "better world of tomorrow" that evolved as the Industrial Revolution became less a revolution and more a way of life in cities across the United States. And it was industry in the gilded raiment in which advertisements and the popular media dressed it that spread the word of industry's promise, and often glossed over the ills.

Rural communities felt themselves far from such developments, watched their populations dwindle as younger people left for the big city and the promise of such a romanticized future. Charlestown was no different--the population had slowly decreased since the turn of the century (see Table 4). Then came C. V. Atwell, the mysterious messenger from that other world, the world of big industry and opportunity, the modern world with its attendant luxuries and greater affluence. Calculated or inadvertent, Atwell's secretiveness did much to stir excitement in that rural town; his statement that "something of vast proportions" may be on its way piqued the rural imagination. Of course he meant and the people envisioned some sort of factory, speculation had it to be a nylon plant, but it was more than that as well. That "vast something" was modern civilization on the town's threshold. Charlestown would not have to go out to meet the world, the world was coming to it.

There was probably some disappointment when it was announced that the "something" was an ammunition plant rather than an industry that promised more longevity. War plants come and go, a fact that became very obvious with the end of World War I, but nylon was a thing of the future and would have promised more durable development for the town. "Some Charlestownners gloomily expect the bubble to burst in a few years and leave the town looking like a carnival grounds the day after the carnival leaves. Others foresee permanent benefits" (Miller 1941:n.p.). But little seems to have been said in the negative. After all, the ammunition plant would bring new opportunities to the area, as well as the chance to be involved in the war effort--the first in the United States to do so, no less.

Although the play was not produced until 1942, the ideas it grew from existed, perhaps in nascent form, at the time of the announcement that the plant was to be built. The promising, ideal future was envisioned in the first representatives of the outside world to arrive in town. "These men are as fine, clean, and upstanding as any community could hope to have. We, as old residents and business men, are truly surprised at the high ideals and standards of this entire group" (Bolly 1940). "Charlestown Infair" gives a glimpse of how the people of Charlestown assimilated the plant into their area, how they let its coming help give them a sense of belonging in the era, linking the belching smokestacks and industry's harnessing of nature in the Modernist ideal to the Main Street and farmland of rural America. To, in other words, Charlestown.

Preparing for the Newcomers

In August 1940 the Advisory Commission to the Council of National Defense established the Division of State and Local Cooperation and urged states to set up their own defence councils. The Indiana General Assembly passed the State Defense Act on March 10, 1941, which established the State Defense Council and appropriated \$200,000 for its use in aiding state and national defense efforts. These two actions helped promote national defense at a grass roots level and helped spur and coordinate civilian defense efforts by encouraging localities to organize and become involved in the national effort. The governor of Indiana then set up the Governor's Emergency Defense Council, which set the scene for the provision of a coordinator to Charlestown, who would be sent shortly after construction began (Field and Stoner 1943:45-48).

In Charlestown itself little seems to have been done to prepare for the coming multitudes, probably because few thought the new arrivals would come in the huge proportions that they did (Figure 40). The common perception was that the population could possibly double. The town had only a small budget (the estimated budget for 1941, approved in August 1940, totaled \$9,665.00), and money had to be spent in the areas it was most needed, so the town board likely took a wait-and-see attitude rather than spend precious funds on projects that may or may not be crucial (Anonymous [1949]:August 14, 1940, and attachment to p. 45).



Figure 40. Lining up at the bank on a crowded Charlestown street, construction era (photo courtesy Charlestown Clark County Public Library, Charlestown, Indiana).

There was, however, a special police fund of \$700.00 set up. The minutes of the town board show the four members still met about twice a month (they were later to meet up to several times a week) and that no new ordinances were passed during the months immediately preceding the beginning of construction.

Construction Begins

The first government representatives arrived in Charlestown on a hot evening, the last Saturday of July 1940. They were preceded only by a Du Pont surveyor and enough mail to fill nine post office sacks. A laboratory in the basement of the school building would serve as a temporary office (IOW [1942]a:July 27-29, 1940). They were there to prepare the way for construction, and one of their biggest jobs would be hiring.

Ordinance had determined locals would be hired before those from outside the area, and Colonel Kelly H. Lewis reiterated the same via newspapers during the following weeks. Still, prospective employees came to the area from all across the country, in spite of pleas from Ordinance to stay away (*The Evening News [EN]* 1940). The first employment office opened in September in Louisville. According to police estimates, by 7:00 the morning after it was announced in the paper that Du Pont would begin hiring at that office 7,000 men were in line. The opening-time line at the second office, in Charlestown, which opened soon thereafter, would often be two blocks long (Steeg n.d.:2).

According to some of those who had long lived in Charlestown, these people came from everywhere. Ed Howard, a construction engineer in the 100 Area, said the people were of every type--"you had mean ones, and you had timid ones and you had dirty ones and you had clean ones . . ."--as well as of great racial and national mix. "I imagine you would have found every nationality [he mentioned German, Italian, and Mexican], but your predominant was black and white" (Howard, interview 1994). Other informants were more parochial in their concept of "everywhere." One mentioned Kentucky and New York. Others illustrated the word with the names of towns, many within a radius of 200 km (125 mi), and none could remember many African-Americans or immigrants from other countries arriving in Charlestown (Hock, interview 1994; McVicker, interview 1994; Payne and Payne, interview 1994; Richey, interview 1994).

Whatever the local impression, Ordinance kept to its promise to hire local labor, with most of the first hires coming from southern Indiana and Louisville, Kentucky. "Most everyone wanting to work from this community and who can pass the physical examination is being put on the job. This had taken nearly all of our unemployed, many of our farmers, and most of the low-paid employed" (Bolly 1940). In March 1941, 9,000 of the 17,500 Du Pont construction workers were from the Falls Cities area. Subcontractors had about 8,000 additional Falls Cities residents working for them. Those from outside the area were mainly millwrights, riggers, steel constructors, and other skilled craftsmen who could not be found in the local area in sufficient quantities (*EN* 1940).

A special census of Charlestown was completed in January 1941. Mainly compiled to help postal and telegraph workers locate newcomers among a population more than three times that which they were used to, it also revealed that among the 3,167 residents of Charlestown were people hailing from 46 states and one territory. And it showed that many had brought their families with them, even those from the more distant states (McManus 1979:13; Zachary 1941:n.p.).

Many job seekers were migrant construction workers who moved around the country with the work. Others had few or no special skills. "There were drifters among them," said Charlie Lutz, who owned a cafeteria during the construction phase and thereafter. "Many came to Charlestown without a penny in their pocket." Like most Charlestown residents, Charlie Lutz wanted to help out a person in a bad situation, so he sometimes gave those who could not afford a meal a \$5.00 book of meal tickets from his restaurant on credit. They surprised him with their honesty, as during the entire time only one or two failed to repay him (Flynn 1973:A1).

Most of the workers seemed to be earnest and industrious and felt they were doing their part to contribute to national defense (Miller 1941:n.p.). Construction workers living in Louisville were reported to be on average about 35 years old, and judging "by conversation, dress and general appearance . . . they are, for the most part, skilled workers--carpenters, electricians, iron and steel workers, concrete men [and] sub-contractors" (Anonymous n.d.e:n.p.).

The work also attracted a number of people not directly looking for work at the plants. Hawkers showed up with their wares and set up shop on streets and sidewalks, and a carnival moved onto a lot that had not yet been filled with trailers (Steeg n.d.:2)

Housing

During construction Charlestown took on the look of "a western gold-mining town. . . . [It] went from a sleepy country town to a madhouse. There wasn't a room, there wasn't anything that anybody could stay in. They had tents, they rented out barber chairs to sleep in. . . . There was just no space any place that wasn't utilized." This was true of the Falls Cities area as well (Howard, interview 1994).

Where to put all the people was the greatest problem Charlestown faced throughout construction. There was only one hotel, the Hotel Residence, a big colonial style house and the former home of a local judge, Ward H. Watson. It was full at 42 guests, and had been home to that many Du Pont and government personnel since the summer of 1940 (Miller 1941:n.p.). With only about 300 houses in the town (Stoner and Field 1943:46), an average of three people to a house, there was no quick or comfortable solution. Cars were moved out of garages, which were converted into bedrooms or small dormitories. Those with trailers were allowed to park them in front and back yards, or they simply set them up on empty lots. There were no regulations in the beginning so all one had to do was check with the owner, if even that much. Tents lined the main road into town off Indiana Road 62 (later U. S. Highway 62), and in the absence of a tent one simply slept in the car (Steeg n.d.:2).

A survey by the State Board of Health showed there were only 74 rooms available in a 10-mile radius of Charlestown by December. According to one reporter, the Federal Housing Administration (FHA) had by then approved a subdivision north of Charlestown and would provide mortgage loans for the construction of 100 new homes there (Shead 1940:3). By this time the average number of people living in each house in Charlestown had gone from three to about 12. Rents had doubled and many trailer camps had sprung up (*LT* 1940).

The rooms that were available rented for \$4.00 to \$6.00 per person per week, \$7.00 to \$10.00 with board. Newspaper advertisements show beds could be had for 35 cents, but whether this was for a night or for a shift (8 hours) was not stated. There was also one place that offered lodging to what a reporter called "transients"--a large frame house near the square, owned by E. R. Burns and purchased with the money Du Pont paid him for his farm. Beds were about \$1 per person, usually shared by two men to a bed. At the beginning of January 1941, a 50-bed bunkhouse was opened, owned by a man and his son who had set up similar operations in other boomtowns. Beds were allotted to one person only, which was emphasized, at \$4.00 per week. It had a large washroom "with showers, wash basins and modern toilets" (*CC* 1940a; Miller 1941:n.p.).

By October 1940 nine official trailer camps had been established within the town limits, each lot going for about \$1.50 per week (Figure 41). One of the larger camps was run by the Midwest Company, which also sold trailers in town. Just a few minutes walking distance from where the administration building would stand at IOW #1, it could hold 100 trailers and provided showers, washing facilities, a tool house, and eight WPA toilets, as well as "elaborate lighting" (*CC* 1940b). By the following March there were 23 camps containing a total of 536 trailers. The occupancy rate was 3.78 persons per trailer at that time. In addition, many other trailer camps had sprung up outside the city limits, some "so close as to be able to use the



Figure 41. Johnson's Trailer Camp (photo courtesy Charlestown Clark County Public Library, Charlestown, Indiana).

municipal water and sewer systems" (Stoner and Field [1942]:50). When the Health Department conducted its survey in March 1941, over half (1,626) of the total population of 3,163 were living in trailers (*LT* 1941a).

Although unregulated at first, in mid-1941 the town board passed Ordinance Number 56, which stated that camps had to be licensed by the Indiana State Board of Health, and that no trailer or any kind of temporary shelter could be used for living quarters unless they were set up in a licensed camp (Anonymous [1957]:attachment to p.15). Most trailer owners cooperated. However, many lots had little to no shade, so when summer came some owners would move to cooler areas along creeks, and a clumsy game of hide-and-seek would ensue (McManus 1979:6).

Food

The other basic necessity that had to be provided for the new arrivals was food. This was often provided at the same place where one was lodging, but with the pay as high as it was people often ate out. Between August and December 1940, the number of restaurants in Charlestown grew to 14. If one was willing and had the means, the selection expanded to 31 in a 16-km (10-mile) radius of the town, more if one went a little further to Louisville. In October a cafeteria which could seat 150 opened at the construction site as well (Stoner and Field [1942]:54).

One of the early restaurants set up to cater to the new immigrants in Charlestown was owned by Charlie Lutz. On the advice of government and Du Pont representatives, he converted his small eating establishment and dance hall into a cafeteria prior to construction. He had expected to be busy, but his expectations did not prepare him for what actually happened. It hit "like a bomb. . . . The first thing I knew I was feeding 86 people every 50 minutes or so from 4:30 in the morning until 11 at night." For 35 cents Lutz served meat, two vegetables, bread, butter, and a drink. The line to get in would at times be three blocks long. "They weren't particularly interested in what the food tasted like so long as it was clean and nourishing" (Flynn 1973:A9). Nourishing maybe, but the restaurants in Charlestown during this time were not known for cleanliness, and took a lot of criticism for that. However, the problem was to a large extent caused by the condition of the roads, and the amount of mud patrons brought in. Throughout construction, the time of the most pressure on these establishments, there were no serious outbreaks of food poisoning or other food-borne diseases (Stoner and Field [1942]:59).

Entertainment

In Charlestown itself there was little to provide entertainment. The pool room may have had pinball machines in addition to billiard tables since a fee covering such machines was mentioned in the minutes book of the town board (January 5, 1941). And, at least according to one source, there was a theater open four nights a week and there had been a bowling alley at the beginning of the boom, but it was soon turned into a grocery store. Charlie Lutz' dance hall had been turned into a cafeteria, but a dance hall would have been short on entertainment value since "it would be mostly a stag affair, for there are few unattached girls here" (Miller 1941:n.p.). There were two package liquor stores and a single tavern (Figure 42) where "every night was Saturday night and Saturday night was chaos" (*LT* 1940). And there was the occasional card game in the back of the barber shop, sometimes going all night. It is likely this was the shop owned by Harry Payne, who said there was no serious gambling at his game (MacDonald 1941:n.p.; Payne and Payne, interview 1994).

Although by most accounts Charlestown was woefully lacking in recreational outlets, one reporter gave a much rosier picture--set, however, against a grim background.



Figure 42. Charlestown's one tavern, where "every night was Saturday night and Saturday night was chaos" (photo courtesy Charlestown Clark County Public Library, Charlestown, Indiana).

One of the most serious problems with which the town was confronted was the matter of recreation. People who work all day under the tension which is always evident in a boom area, demand leisure-time activity. Lacking such an outlet for their energies, they will turn to less healthful pursuits. With 2,000 people living in 800 trailers in 21 licensed camps, a system of decentralized recreation had to be devised. The WPA undertook this important task and assigned Lester E. Campbell, a veteran in the field of recreation, to the southern Indiana area. Mr. Campbell soon had a program started which included educational classes, handicraft classes, library services, dancing classes and athletic activities. He also had a dance band organized which provided music for weekly dances and concerts (Zachary 1941:n.p.).

It should be noted that this glowing description was for all of southern Indiana, not specifically for Charlestown. Zachary added that the extent and diversity of this program also seemed to have held less socially acceptable avenues of entertainment to a minimum.

Leaving Charlestown there were added possibilities. To the north, at New Washington's Elice Theatre, one could see movies like "Young Buffalo Bill" with Roy Rogers and Gabby Hayes (CC 1941b). And those not satisfied with the low-stakes poker game at the barber shop could go south to the Falls Cities area, where although not strictly legal there were a good many gaming establishments like the Club Lido Venice, Log Cabin, and the Silver Creek Country Club to name a few of the larger ones (Howard, interview 1994; LC-J 1972:n.p.).

A little later, and of perhaps a more wholesome nature, a New Comers' [sic] Club was organized in Charlestown, mainly for the wives of the construction workers. It met once a week in the morning and the members were "knitting and sewing for the Red Cross" (CC 1941c). One of the churches set up a recreational center "for the wives and children of the immigrant workers." And a lending library was set up, which was reported to have done a booming business (Steeg n.d.:5).

Reaction of the Locals

The people who had lived in Charlestown prior to the boom were generally fatalistic about what was happening in their town. It was not something they could stop even if they wanted to, so they would just do the best they could. Some saw the event as a harbinger of good opportunity--for one thing the outside and much more modern world was coming to Charlestown, and one of the things it brought was better pay. J. A. Hock feels he "would be an old man and still not have anything" except for the plant's coming. His family had a roofing business in New Albany prior to that. Roofing was seasonal, which he felt "pretty well stymied" his ambition to make a better life for himself, so the first winter of construction he applied at the plant. He worked there until he retired (Hock, interview 1994). The local barber said that the plant brought a lot of money to the community as well, not just to those who found employment there. The workers were paid well and they spent a good deal of their money in Charlestown. He had more business than he could handle in the barber shop, and also mentioned that the package stores did really well (Payne and Payne, interview 1994).

To the local eye, the work across Indiana Road 62 must have been amazing. In place of the scene they had grown up looking at--corn fields stretching into the distance--there were now fields of cars and building materials and a colony of thousands of workers moving among the growing structures. A writer for a nearby town paper gave a vivid description of this hum of activity.

[There were] forests of huge electric cranes, mountains of building materials; the machine gun noise of riveting machines; scores of excavating machines, eating into the hillsides, levelling ravines; . . . the din of huge freight trains and a score of switch engines; the shouts of teamsters, coupled with the noise of 10,000 men working, may present some picture of this gigantic project which has come to disturb the sleepy hibernation of the little town. . . . The roar and thunder of frequent dynamite blasts shake the ground and rattle the windows of century-old buildings. At night the glare of searchlights, and the reflection of millions of electric lights can be seen for miles, as the work is pushed night and day with three shifts of men rushing this project in the defense program (Shead 1940:2).

Impact on the Town and its Infrastructure

It was the advent of scenes like this and the crush of people moving in to help create it that disturbed the sleepy hibernation of the town board as well. They appealed to the State Planning Board of Indiana for assistance. The Planning Board replied that although they would like to help they had no funds to do so--in the last session of the legislature, it had been decided that the Planning Board was an unnecessary expense. (The State Defense Council, which would later help fund such assistance, was not set up until March 1941). Henry B. Steeg, a member of the board and municipal engineer for the city of Indianapolis, volunteered to go to the town and spend a few days determining whether the situation was as bad as had been reported in the press. His trip there convinced him it was much worse, especially in the areas of public health and sanitation.

Steeg set up a meeting with the governor, M. Clifford Townsend. Governor Townsend agreed that something needed to be done and arranged a second meeting, at which several representatives of state and national agencies were in attendance, including John J. Jennings, State Director of the WPA; Laurence V. Sheridan, Regional Director of the National Resources Planning Board; Thomas A. Moynahan, Chairman of the Indiana State Housing Board; Dr. John C. Ferree, Director of the Indiana State Board of Health;

Professor G. E. Lommel, Chairman of the Indiana State Planning Board; and Hubert Gallagher, Assistant Director of the Division of Municipal Cooperation of the National Defense Council. The five members of the town board of Charlestown were also there to tell of their helplessness in facing the huge task before them. At the meeting it was decided that an experienced administrator was needed for the town, and that special funding could be found to support the position. The governor asked Steeg to fill the position, which would carry the title Defense Planning Coordinator.

Charlestown's first coordinator opened his office on October 16, 1940. His first order of business was to determine areas where the need for action was most pressing. At a meeting that evening with the town board members these were decided:

1. Proper sanitation and public health measures;
2. Additional school facilities;
3. Jurisdiction over building construction and use;
4. Additional police and fire protection;
5. Proper traffic control measures; and
6. Recreational facilities (Field and Stoner 1943:42-43; Steeg n.d.:2-3).

Officially, the coordinator's job was to funnel information from state and national agencies to the local government and vice versa. Unofficially, he acted as a point of contact for "all agencies and offices operating in the Charlestown area" (Field and Stoner 1943:45-46). He gave advice rather than directly administrated, but the town board acted on that advice more often than not. Although the board members were completely vexed by the enormity of the task, by leaning heavily on Steeg's experience they made great progress and were well on the way to turning the town into a city in only a matter of months.

Steeg remained in Charlestown from October to early December 1940, when he left to work on state-wide defense coordination. His replacement was also an engineer, and he had worked on several government projects. James E. Zachary served as coordinator until September 1941, when he resigned to take a federal job. Zachary felt the town no longer needed a coordinator, but the town board objected. A third man was assigned to the position, Frank G. Thompson. His experience differed from that of the other two coordinators, having a strong background in finance. And his role was transitional and short-lived; he spent only a few days each week in the town (Field and Stoner 1943:46-48).

Avoiding a Health Crisis

As was related in the section dealing with the setting in Charlestown prior to the beginning of construction, the threat to the health of residents new and old stood to be very great. The incidence of typhoid fever was 2.5 times the state average, and there was a greater occurrence of dysentery and tuberculosis (Field and Stoner 1943:43). There was also fear of a malaria outbreak since some of the workers came from the deep south and could have brought the disease with them. The sewer system that was being installed was still far from operable, and the date of its completion was anybody's guess.

All these problems were compounded by the fact that everyone had to live in such close proximity to one another. With little time for immigrants to adapt to local strains of diseases and vice versa, the spread of some communicable disease could easily have assumed epidemic proportions. In an effort to determine specific areas that posed the greatest danger, a health survey was conducted in March 1941, which focused on establishing the number of disease carriers in the area. From this work it was learned that the greatest threat came from typhoid fever and smallpox, so a 12-month immunization program was begun July 1, 1940. During this time 537 people received vaccinations for smallpox, 90 for typhoid fever, and 724 children were inoculated against diphtheria. The typhoid fever immunization program was continued, and by August 21, 1941, 439 people in Charlestown and the surrounding area had received three injections, 22 had received two injections, and 32 had received their first shot (Stoner and Field [1942]:32, 65-68).

Inoculation was a good preventative measure, but Charlestown also needed to tackle health problems at their sources. The State Board of Health adhered to a policy of voluntary cooperation and education as much as possible. Free health films were shown weekly in the school building on the town square. Public toilets were installed, two in alleys and one in the street (a shock to some residents), early in the construction era. After school let out in the spring of 1941 the school toilets were opened to the public until the merchants and restaurants were hooked up to the sewer system, late in the summer of the same year. And work on the sewer system itself was speeded up, the first connections being made in April 1941 (CC 1941d; Stoner and Field [1942]:28, 43, 47).

The State Board of Health also had jurisdiction over the trailer camps, a responsibility delegated to the agency via the 1935 Tourist Camp Act, which was sufficiently broad to apply to the mushrooming trailer camps. Its authority was strengthened in Charlestown by Ordinance Number 56, which regulated "mobile dwellings" and specifically mentioned the state board as the licensing agency (Anonymous [1957]:attachment to p.15). The act regulated licensing, water supply, sewage and garbage disposal, set lot sizes, and called for the reporting of illnesses. The trailer camps had to be inspected continuously because there seemed to be an overpowering tendency to park units too close together--and if a bad practice were not checked quickly it spread throughout the camp. The inexperience of the people operating the trailer camps did not help either. But in most cases owners and operators readily complied with the board's directives (Stoner and Field [1942]:51-53).

It was thought Charlestown would have a high potential for prostitution, and therefore for venereal disease, but the only increase, at least during the construction phase, seems to have been in the Falls Cities. Close cooperation between health and police departments, and an occasional quarantine for the treatment of venereal disease, kept the health risks to a minimum. In addition, all new male employees at the plants were tested for syphilis, and those showing a positive reaction were referred to the district health department. A nurse was sent to talk to them and advise them to visit the local clinic (funded by the Public Health Service) to receive, in most cases, free treatment. The testing of potential employees by Du Pont and Goodyear did reveal a racial factor in the incidence of syphilis, which may have also been used to rationalize hiring prejudices against African-Americans. At the very least it supported a negative bias:

The amount of infection among negroes was so high that it almost became impracticable to try to employ them, though it must be added that not all infected persons were denied employment for that reason (Stoner and Field [1942]:71).

At the town, county and district level, the boom era in Charlestown probably impacted the health services more than any other governmental service (Stoner and Field [1942]:7). But the fact that during the period of greatest population influx not once was the health of the community seriously threatened shows that those in charge were highly successful in carrying out their responsibilities.

Utilities and Transportation

With the cooperation of Federal and state agencies, Defense Coordinator Steeg speeded up the construction of the sewer system soon after his arrival, in the fall of 1940. The WPA brought in workers from surrounding towns and started working in two shifts, getting water closets tied in months before they would have at the previous pace (Steeg n.d.:3-4).

The streets had always been a problem in Charlestown when it rained. None were paved and with the increase in traffic (Figure 43), the mud even gained a reputation in a wider area. Before leaving for the town, a friend told one reporter not to go--"You will simply drown in that mud" (Smiley n.d.). The WPA was called in to help solve this problem also. They began work in July 1941, and before they left they had paved most of the streets in the town (CC 1941e; Steeg n.d.:5).

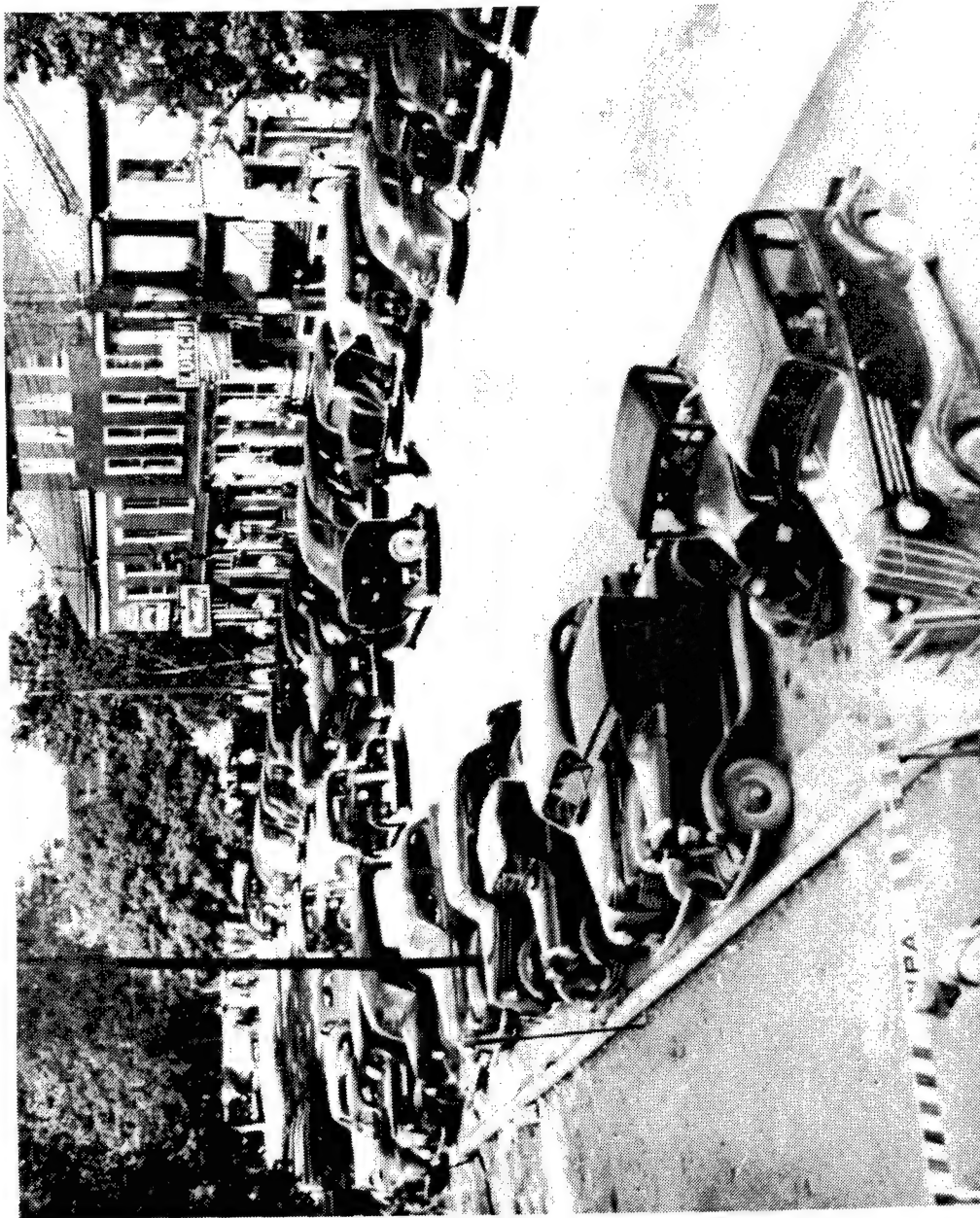


Figure 43. Traffic and parking were problems in boom-town era Charleston. The WPA, whose barricade can be seen in the lower left corner of the figure, laid the town's sewer system and paved the roads (photo courtesy Charleston Clark County Public Library, Charleston, Indiana).

To get all the new residents from the surrounding areas to work and back home again, many new bus lines were started. And the Burlington & Ohio operated special 20-coach shuttle trains to carry workers, stopping in Jeffersonville and New Albany on the Indiana side of the Ohio River, and in Louisville on the Kentucky side. Approximately 4,500 people were riding these trains each day in August 1941. And there were just as many cars in the parking lots (Crowell 1941:8).

Housing

Although the people in administrative positions in Charlestown regarded health concerns as the most serious problem, the lack of space was viewed by the average construction worker as most pressing. A reporter who wrote a regular column for the *Charlestown Courier* under the pseudonym "Old Timer" recounted the complaint of "an inebriated passenger" on one of the Charlestown buses: "In Charlestown there are six beds in a room and 16 men to a bed. I'm going back to Birmingham where the mosquitoes are 20 inches long" ([Old Timer] 1941b).

There was talk of federally funded housing projects from the beginning of construction, but since the official word was that the plant would be shut down when the war was over no federal agency wanted to build in Charlestown. If there were houses to be built they should go in at Jeffersonville or Louisville so they would not be abandoned after the boom. Soon private builders began adding on and remodeling houses and there appears to have been a privately developed subdivision called Dupontia or Dupontonia (see Figure 4), now known as Charles Place (Anonymous 1945:n.p.; Meurer, interview 1994).

The press for quick solutions was not likely to encourage quality construction, or quality buildings that could continue to benefit Charlestown after the war was over--especially in the absence of a building code. So Defense Coordinator Steeg drafted a building code and the town board of trustees adopted it as Ordinance Number 51 on November 6, 1940 (Anonymous [1957]:10). A State of Indiana Fire Marshal inspector was loaned to the town and put in charge of building inspection under the broad title of Director of Public Works and Safety. He was told to go strictly by the book in enforcing regulations, and one of his first actions was to condemn an 80-year old residence that had been converted into a rooming house. "Every available square foot was occupied by a bed. This three-story structure had only two exit doors, and a fire there would probably have resulted in a large death toll" (Steeg n.d.:4; Zachary 1941:n.p.).

Much that has been written about the relationship between the board of trustees and Defense Coordinator Steeg indicates all worked wonderfully together, that the board almost always followed the coordinator's advice and that all were on very friendly terms. This would be expected in the writings of the first two coordinators, Henry B. Steeg and James E. Zachary, but it is also stated in no uncertain terms in the three reports prepared by Indiana University's Bureau of Government Research dealing with the Charlestown boom and with the position of Defense Coordinator. However, they did have their differences, one of which may have been a conflict between the government representative and the business interests of some members of the town board. On November 12, 1940, a few weeks before Steeg gave up his position as coordinator for the town, "Doc" Pangborn and two other members of the board of trustees called on Colonel Hardy. They complained that Steeg "had interfered with the prospective privately financed housing which was in prospect" and said they recommended "that Mr. Steeg change his attitude or that someone else be appointed in his place" (IOW [1941]:November 12, 1940).

Two days later Steeg and a member of the National Resources Planning Board, L. Segoe, went to see Colonel Hardy to discuss the local housing situation. The topic of the conversation, though, was bad press about housing and crowded conditions that was influencing the decision in Washington to increase the number of production lines at IOW #1 from four to six. Steeg was of the opinion that if the increase went through, a federal housing project for Charlestown would be necessary (IOW [1941]:November 14, 1940). If Steeg was trying to interfere with privately funded housing it may have been that he thought this would hurt the

chances of the town to receive federal assistance later, or that he thought federally funded housing would benefit the town more. It is unknown whether these events influenced Steeg's decision to leave Charlestown a few weeks later and take a job as statewide defense coordinator.

Education

Although it ranked high on Steeg's list of priority needs in Charlestown, there was no quick solution to overcrowding in the school. In fact, little was done during construction, the time of worst need. Steeg noted that "child education suffered a serious set-back during the time the powder plant was being built" (Steeg n.d.:4).

The Charlestown school could accommodate 500 children, and enrollment was at capacity in September 1940. By April 1941, the student body had grown to 800. The gymnasium, lunchroom, and every other available space was put to use, and children who could not be fit into the school building attended classes in two local churches. The Federal Works Agency did eventually assist in building a new school, but this was not completed until after the construction influx had passed (Steeg n.d.:4; Zachary 1941:n.p.).

Law Enforcement

At the beginning of the boom Charlestown had a police force consisting of only a town marshall. In a letter to *Business Week* early in the construction period, Charlestown's bank president said he was "still handling the job and not having too much to do" (Bolly 1940). His only problem was directing traffic, according to Bolly. But that was just the beginning. Some indication of how much the marshall's work increased can be gained by looking at the number of fines levied by the justice of the peace, who set the amounts that persons arrested by the marshall would be fined. During the first half of 1940 the justice fined only two persons; the figure for the next six months jumped to 82. During the first half of 1941 it was double this figure. These numbers fall short of the total number of arrests made by the marshall because of the sensitivity of the Charlestown justice to accusations that justice of the peace officers find a high percentage of persons guilty so they can collect a fee, that is, the defendant's fine. Local gossip had it that to avoid such accusations this justice replaced fines in some cases with sentences of Sunday school attendance. Town administrators encouraged him to be more severe as the boom era wore on (Stoner and Field [1943]:13).

Soon a deputy marshall and night watchman were hired to help out. The night watchman was paid in part by the town board and in part by the merchants because his duties included sweeping the streets in front of the stores (Stoner and Field [1943]:13-14).

The Clark County Sheriff was responsible for a wide range of duties that seem to have at times overlapped those of the town marshall. And typical of rural policing activities, locals were sometimes treated "more fairly" than outsiders. At one time the sheriff and several deputies arrested a substantial number of people for trespassing because, during the change of shifts, they were running across people's property and knocking over fences. There were so many trespassers and so few deputies that some prisoners were able to escape in the confusion before they could be taken to the court of the justice of the peace. One observer noted "with a twinkle [that] all of the trespassers who had a voting residence in Clark county escaped." It seems, however, that this action was enough to discourage future trespassing (Stoner and Field [1943]:18).

The number of arrests by the sheriff increased dramatically during the construction of the plants. The sheriff estimated the daily average number of prisoners in the county jail at Jeffersonville during 1939 to be 12%. During the height of construction and the annual height of inflamed tempers, in the summer of 1941 (June, July, and August), the daily average rose to just under 37, an increase of almost 300 percent. During the

same period the next year, when construction work had for the most part been replaced by operations, the average fell to about 24 prisoners in the jail on any given day (Stoner and Field [1943]:19).¹¹

The next tier of police enforcement operated at the state level. Early in Steeg's work as Defense Coordinator for Charlestown he asked the Indiana State Police to set up a post at Charlestown. They agreed one was needed, but had no funds for construction. Steeg talked to Colonel Hardy and obtained the use of a brick building, which was on government property but outside the fences, for the purpose. Colonel Hardy even erected the police radio tower gratis (Steeg n.d.:4).

In the beginning, the job of the state police at the Charlestown post involved traffic control more than criminal investigation. During the period of March through September 1941 there were 1,085¹² traffic-related arrests (Table 5), compared to 83 criminal and misdemeanor arrests (Table 6). From October 1941 through the following March the figures were 948 and 145 (Stoner and Field [1943]:29). During the ten months of March through December 1941, a total of 29,905 person hours was spent on traffic work, while only 297 were spent on criminal patrol and investigation. Table 5 gives a breakdown of the types of traffic problems with which the state police were dealing.

Table 5
State Police Traffic Arrests

	March-September 1941	October 1941-March 1942
Moving traffic violations*	838	948
Equipment violations	17	30
Drinking violations	136	130
License and registration violations**	112	74
All others***	81	68

* Includes driving while under the influence of intoxicants

** Includes drivers and pedestrians under the influence of intoxicants

*** Principally improper parking

Source: Stoner 1943:30

¹¹ It is not possible to say that construction workers had left and operations employees replaced them in the makeup of the town and county population since many of the construction employees probably stayed on to work in operations. However, it would have been the more responsible construction workers that stayed on since during construction massive amounts of unskilled laborers--anyone who could swing a hammer--were needed. Hiring requirements were more stringent for operations employees. "When they actually started operations . . . they were needing a different quality of people, . . . more college and high school graduates" (Richey 1994). These employees may have been more law abiding due to higher educational levels, a greater sense of responsibility, expectations of making Charlestown or the Falls Cities a long term residence, or the efforts of the police agencies to control crime. In any case, there are several possible explanations for the reduction in the crime rate as construction at the plants gave way to operations.

¹² This figure, although from the same source, does not agree with either the total or moving traffic violations enumerated in Table 5. The number of traffic-related arrests for the period may have been 838, the number of moving traffic violations as stated in Table 5.

Table 6
State Police Criminal and Misdemeanor Arrests, March through September, 1941

Type of Criminal Activity	Number of Arrests
Assault and battery	3
Larceny, grand and petit	2
Armed robbery	2
Vehicle theft	4
Hotel defrauding	1
Desertion of wife and child	2
Disorderly conduct	4
Escape from Indiana State Farm	2
Issuing fraudulent checks	4
Possession of gaming device	2
Liquor law violation	1
Parole violation	3
Provocation	1
Trespassing	2
Public intoxication	47
Other	3
<i>Total</i>	<i>83</i>

Source Stoner 1943:30

The state police conducted a traffic count in February 1941. It was estimated that before construction began on the plants 700 vehicles were passing the future plant entrance on Indiana Road 62 each day. When the state police count was made, a total of 9,700 vehicles passed the plant entrance going south in one 24-hour period, almost 8,000 of those on the road between 6:00 in the morning and 6:00 in the evening. The count going the other direction, toward Charlestown, was 4,329. In comparison, only about 2,500 vehicles were passing a major intersection on one of Indiana's main north-south arteries (United States Road 31) each day. When the shifts changed at the plants there would be so much traffic on the road heading south that when the traffic light 10 miles away at the north edge of Jeffersonville turned red, it would halt vehicles at the plant gates. This situation was improved considerably when the State Highway Commission decided to improve Indiana Road 62, making it a four-lane highway. The work went quickly; it was started in March 1941 and completed by May 30 the same year.

The state police were tough on violators of traffic regulations, with arrests far outnumbering warnings in Charlestown (Table 7). The average for the state ca. 1940 was three warnings to one arrest, but in Charlestown arrests exceeded warnings. The severity of the state police actions in this regard seems justified. In May 1941 in Charlestown there were 159 arrests with 100 percent conviction rate for moving violations and 53 warnings. There were only 10 accidents that month. By July, the number of arrests had dropped to 118 with a 92 percent conviction rate and warnings were up to 83. The number of accidents rose to 23, the highest monthly count for the year. In October arrests numbered 178 with a 94 percent rate of conviction and warnings numbered 117. More arrests were made this month than in any other month of the year, and there were only seven accidents, the lowest monthly figure for the year (Stoner and Field [1943]:33-40).

Table 7
Traffic Enforcement by State Police, March-December 1941, Charlestown Post

Month	All Traffic Violations			Moving Traffic Violations			Number of Accidents		
	Number of Arrests	Number of Warnings	Number of Convictions	Number of Arrests	Number of Warnings	Number of Convictions	Fatal Accidents	Other Accidents	
March	108	79	103	98	72	93	0	18	
April	204	58	197	132	48	128	2	11	
May	173	132	173	159	53	159	1	9	
June	127	117	124	110	64	96	0	11	
July	135	114	123	118	83	108	3	20	
August	162	151	153	126	91	118	0	19	
September	176	122	184	149	65	156	1	17	
October	223	306	212	178	117	168	2	5	
November	200	133	195	149	73	145	3	15	
December	165	95	158	129	51	124	3	14	
Total	1673	1307	162	1348	717	1295	15	139	

Source: Stoner 1943:35.

Arrests for criminal activities increased as time went on. There were 83 criminal arrests during the seven months of March through September 1941 (see Table 6). The figure for the ensuing six months (October 1941 through March 1942) rose to 145. And during the next six months the figure increased to 299. This increase was not in proportion to the population increase and probably does not reflect an increase in criminal activity. It instead reflects changes within the police system itself. During this time the administrative area covered by the post expanded from covering a portion of Clark County to include six counties. More officers and a detective were added to the force as well, and changes were made in the way the state and local police worked together. Improvements to the main road to and from the plant reduced the number of hours devoted to traffic control as well, freeing officers for other duties (Stoner and Field [1943]:18, 31).

Not a few people were surprised that Charlestown did not have to suffer usual boomtown pains in this area. Gambling and vice were nearly nonexistent in Charlestown. One writer attributed this in part to the high pay rates on the construction sites, which meant construction workers were taking no chances by doing something that might result in their being fired. And there was less time to even consider doing something that might get one in trouble since so many were working as much as possible to get the time-and-a-half overtime pay. He also mentioned that gambling had not been allowed for 124 years, and the city officials intended to keep it that way. "Joe [Peyton, the town marshal] and I [C.F. Pangborn, president of the town board] could have made \$50,000 if we would have agreed to pay no attention to gambling, but we're not built that way. We told the gamblers to get out and stay out. We don't want them here." Dr. Pangborn dealt with prostitution with similar measures of certainty and tact: "We watch them as close as we can and don't let them light over night" (Miller 1941:n.p.).

The construction period was a busy and often chaotic time for law enforcement officials in Charlestown. It was said that "the town marshal had a reputation of never sleeping during the construction period, and the state police were regularly on duty from sixteen to twenty hours daily" (Stoner and Field [1943]:48). But although busy and confusing, there was no great increase in crime of any type during the period, even petty thievery, which is surprising when one considers that approximately \$700,000 were distributed among the workers on paydays at the height of construction. It would seem the police departments at all levels carried out their duties with a great deal of success.

Effects on the Local Economy

The boom may have been a source of many headaches for those in education and law enforcement, but it was cause for celebration in the business community. When *Business Week* interviewed S. E. Bolly, president of the First Bank of Charlestown, about the effects of the boom he gave a glowing review of the financial aspect. Money orders were up 800 percent and postal savings up 200 percent. A Western Union trailer that opened for business December 1, 1940, was doing brisk business. One chain store had come to town, which he viewed as evidence of outside confidence that Charlestown's economic prosperity would not collapse at the end of the war. Twenty-five new houses had been built, and more were to go up when the weather improved. And land for 75 housing units to be built by the Federal Housing Authority had just been purchased (Anonymous n.d.f).

Things were going well also for Bolly's bank. On June 19, 1940, the bank's deposits totaled \$160,5053.53 and it had resources totaling \$229,243.46. In December the status was approximately the same. But by April 7 of the following year, deposits had increased to \$818,600.00 and total resources stood at \$867,646.85 (Figure 44). "Few banks in the United States have ever been confronted with an increase in deposits in six months which approximated 500 per cent" (Crowell 1941:8).

The buildings in the Charlestown district that had been renting at "less than that paid for residences in more thriving communities" (Stoner and Field [1943]:7) had by January 1941 jumped from \$20.00 to \$25.00 a month to \$100.00 to \$150.00 per month ([Old Timer] 1941b).



Figure 44. Workers make deposits and cash paychecks at the First Bank of Charlestown (photo courtesy Charlestown Clark County Public Library, Charlestown, Indiana).

Wartime Operations

The Housing Shortage Continues

There is no clear distinction between construction and operations with regard to a discussion of the boomtown effects at Charlestown since construction began in stages and continued after operations had begun. The housing problem was certainly the most visible. The original plan of having only a single plant with two smokeless powder production lines faded farther and farther away as Ordnance decided to place the bag loading facility next door and twice upgraded the production capacity of the powder plant. This meant more people would be living in the area for a longer period of time than had been originally thought. Washington had earlier balked at building federally funded housing in Charlestown itself, saying such units should be constructed in the Falls Cities area, where they would be less likely to go to waste after the war. But with the tremendous increases in the size of the facility and the demands placed on the transportation industry, and drivers themselves when the war needs necessitated rationing, the government had a greater responsibility to provide housing, regardless of whether or not Charlestown went from boomtown to ghost town.

There were defense housing projects already going up in Jeffersonville and New Albany, to the south, when Charlestown's first was started. Named after the first governor of Indiana, who was also born in Charlestown, it was officially called Jonathan Jennings Terrace but usually shortened to just Jennings Terrace. The units would be rented to defense industry workers only, with one-bedroom units designated for two- to three-person families, and two-bedroom units for three- to five-person families. Rental amounts would be determined by annual income of the defense worker. Those earning \$700.00 - \$800.00 would pay \$12.00 per month (the lowest); those earning more than \$3,000.00 a year would pay \$50.00 per month (*The Action of Indiana Ordnance Works [AIOW] n.d.*).

Jennings Terrace was a group of 75 units, most duplexes, with the living room and kitchen downstairs and the bedrooms upstairs. These were some help but not enough. They were full as soon as they were completed, and if another 75 had been built they would have filled just as fast (CC 1941f). Solving the housing problem would take an effort of a much larger scale.

Pearl Harbor was bombed December 7, 1941, spurring the United States to become directly involved in World War II. The offensive may have indirectly helped decide the fate of the next housing project in Charlestown as shortly thereafter approval was given for the construction of 378 structures with a total of 748 units (Table 8). They were to be set on a rise looking over Pleasant Creek, just north of town at that time, and so the subdivision was called Pleasant Ridge.

Gunnison Housing Corporation, a prefabricated housing contractor located in New Albany, was to build 336 of the houses and a \$100,000.00 recreation building (Baughman 1993). The remainder were to be provided by another prefabricated home builder, National Homes (Figure 45). Each unit would house up to four families (see Table 8), and rents would also be set according to the salary of the defense worker. The Gunnison Homes had exterior walls sheathed with "insul-siding," plywood interiors, oak floors, and metal windows. The National Homes were of the same construction except the floors were pine and windows were made of wood. All had pier and beam foundations (USFAPHA [n.a.] n.d.:n.p.). There were apparently several thousand applications for these Victory Homes in October 1942, well before they were finished (Baughman 1993). However, when they were first completed, there were few who wanted to rent them until construction on IOW #2 began in December 1944, after which the complex was fully let (McManus 1979:12).

Table 8
Houses in the Pleasant Ridge Subdivision

Type of Building	Number of Buildings	Number of Units
One-bedroom	4	4
Two-bedroom	10	10
Three-bedroom	6	6
Duplex, one bedroom each side	45	90
Duplex, two bedrooms each side	209	418
Duplex, three bedrooms each side	69	138
Duplex, one and three bedrooms	20	40
Duplex, two and four bedrooms	9	18
Four-plex, two bedrooms each side	6	24
Totals	378	748

Source: United States of America Housing and Home Finance Agency Public Housing Administration, General Conditions of Sale (Of Permanent Lanham Act Property Under Sale Plan 1), on file at the Charlestown Public Library.

Before construction at IOW #2 began, though, there was a setback. A tornado hit Charlestown on July 29, 1943, about 6:50 pm, and Pleasant Ridge was directly in its path. Since there were few people living in the subdivision at the time, casualties were light with only seven people injured. But about 200 houses were damaged and 63 destroyed. And more damage seemed to threaten the area--Federal Public Housing Authority (FPHA) Housing Manager T. B. McCrocklin asked Colonel Lewis to send soldiers to guard the project as "pilfering and vandalism had started" (IOW [1945]a:July 30, 1943; McManus 1979:11). McCrocklin was told to contact local and state authorities first.

When construction on IOW #2 began there were many more African-Americans coming to Charlestown to work. But they had more difficulty finding housing than whites. When a representative of the FPHA Chicago Housing Office visited Charlestown to check on a rumor that blacks would be allowed to move into the houses at Pleasant Ridge, he was told in no uncertain terms that the rumors were false. When the representative would not accept the word of Housing Manager McCrocklin, they visited Colonel Lewis in his office. "It so happens that no colored families have applied for occupation of the houses in that area; however, if they should, their applications would have to be denied" (IOW [1945]a:June 12, 1944).

An effort to rectify this situation was attempted, and met with a fair amount of resistance, in a third housing project at Charlestown, which was never completed. The project would have set up temporary housing units, which included 96 moveable houses, 200 trailers, and 240 men's dormitories, all of which would be removed at the end of the war (*LT* 1944). The first of these, which included about 50 trailers and 25 "dwelling units," were available by June 10, 1945, only a short while before the end of the war (IOW [1945]b:June 1). Less than a week before these first units became available, a meeting was held concerning the housing of non-whites there. A National Housing Agency (NHA) representative said there was "an immediate need of 22 or 23 housing units for non-white construction employees" and indicated an additional 100 applications had been received. They had set aside the southern end of the trailer camp for this purpose, but residents of Jennings Terrace, which was adjacent to the trailer camp, were protesting. To avoid a problem, the area designated for use by ethnic minorities was moved to the north side of the camp (IOW [1945]b:June 5).

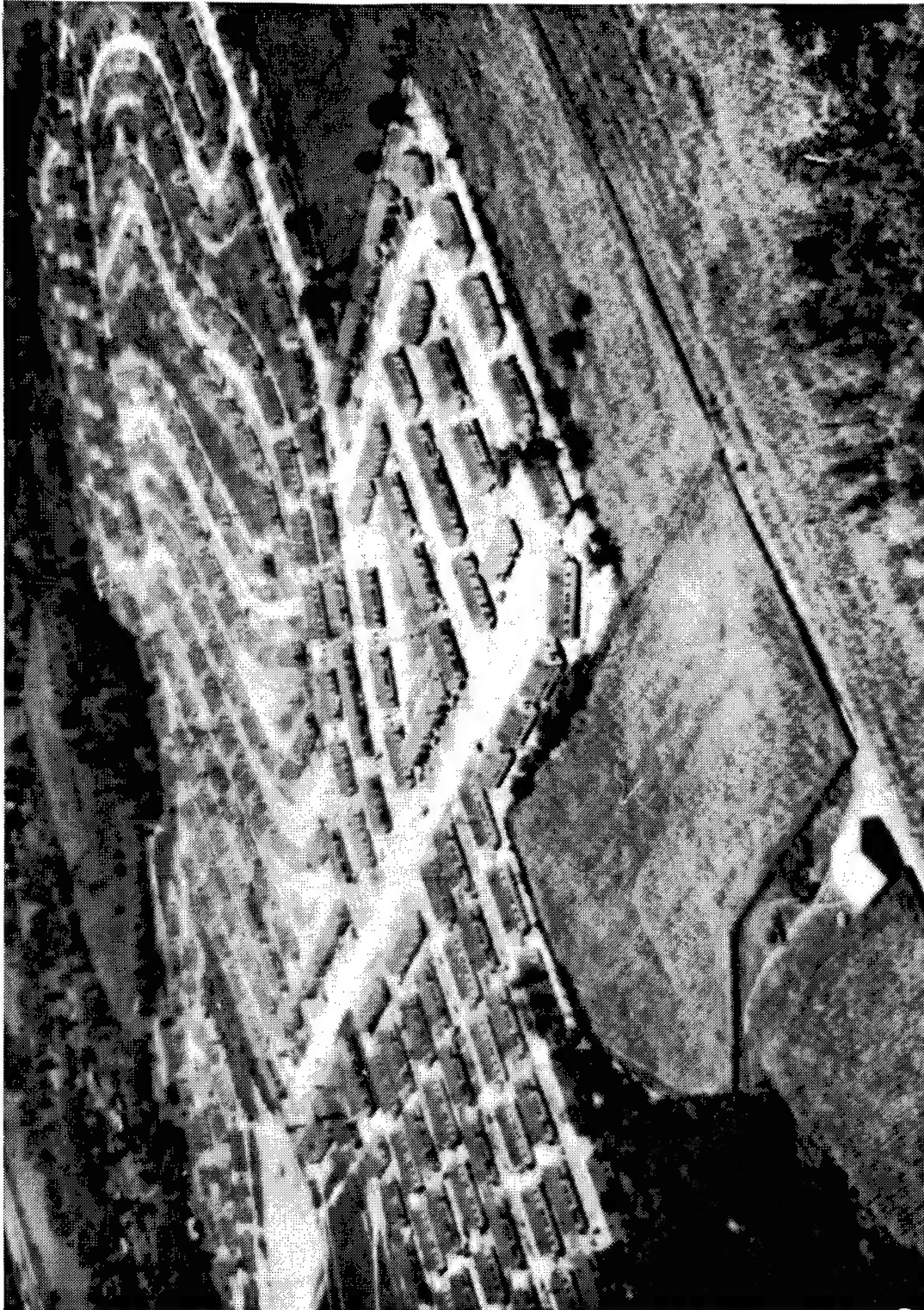


Figure 45. The Pleasant Ridge Housing Project, ca. 1946 (photo courtesy Charlestown Clark County Public Library, Charlestown, Indiana).

This move was not enough for what seems to have been a vocal minority of the Jennings Terrace residents. Two days later, 17 Du Pont employees and one from the Goodyear plant lodged a complaint with Colonel Lewis and threatened to destroy trailers that were set up at the camp. They demanded a meeting with housing authority officials and left a petition with 73 signatories (IOW [1945]b:June 7). Unfortunately, the ploy worked and the trailers became designated "white only." At the ensuing meeting between members of the newly formed Housing Committee (all Du Pont employees and residents of federal housing units) and NHA and IOW officials, the Housing Committee made it clear that "they did not want, and would not stand for colored workers to be housed near the project occupied by white families" (IOW [1945]b:June 12). At a public meeting held afterwards and attended by about 400 housing project residents, the National Housing Program was reviewed by the NHA representative and the floor opened for questions. A show of hands at the end of the meeting revealed that very few residents were dissatisfied at that point. Colonel Lewis noted that "probably a dozen or so of the employees will quit their jobs when colored workers move into the houses, but I feel that these particular ones are agitators anyway and would not seriously affect production" (IOW [1945]b:June 12).

A few days later the Assistant Regional Representative of the NHA called from his office in Chicago to say that no African-Americans would be placed in any of the first group of 125 temporary dwelling units. A section of 130 units, separated from those occupied by whites by a 91-m (300-ft) wide area, would be reserved exclusively for black workers (IOW [1945]b:June 16). The war was over before these were completed.

There were in addition 605 temporary structures for housing IOW #2 construction workers just east of the IOW #1 administration building. They were probably set up in late 1944 or early 1945, not long after the contract to build IOW #2 was awarded (October 1944). These were arranged in two camp areas (Figure 46) and most of the buildings were single-story barracks or hutments with 10 to 20 beds each (Table 9). They added significantly to the number of housing units in the area but only for a limited segment of the population. Occupancy was almost certainly limited to single males.

Transportation Improves

There was some easing of the strain on the transportation system as construction gave way to operations. During 1942, buses carried about 20 percent of all HOP employees to work, and it is likely the same was true at IOW. These buses were very crowded, especially during rush hours, but "a lack of additional equipment prevents an extension of service" (HOP [1942]c:104). Also, there was no public transportation to Louisville, Kentucky (where approximately 45 percent of the work force lived), that did not entail at least two transfers. In light of this, the Indiana State Office of the Office of Price Administration set up a Rationing Board for both IOW and HOP that issued permits for new and recapped tires for personal automobiles and extra gasoline rationing coupons for those in need who worked in the defense industry (HOP [1942]c:104).

Government employees seldom had to avail themselves of public transportation. One morning a lieutenant who worked under Colonel Lewis mentioned he had taken one of the special work trains to the plant that morning and that it was "anything but a train" (IOW [1945]a:March 30, 1942). Colonel Lewis replied that if it got him to work then it was doing everything the B & O people had promised. The lieutenant also mentioned that there were two women on board. The B & O people had not promised to get women to work --they were not supposed to ride the trains.

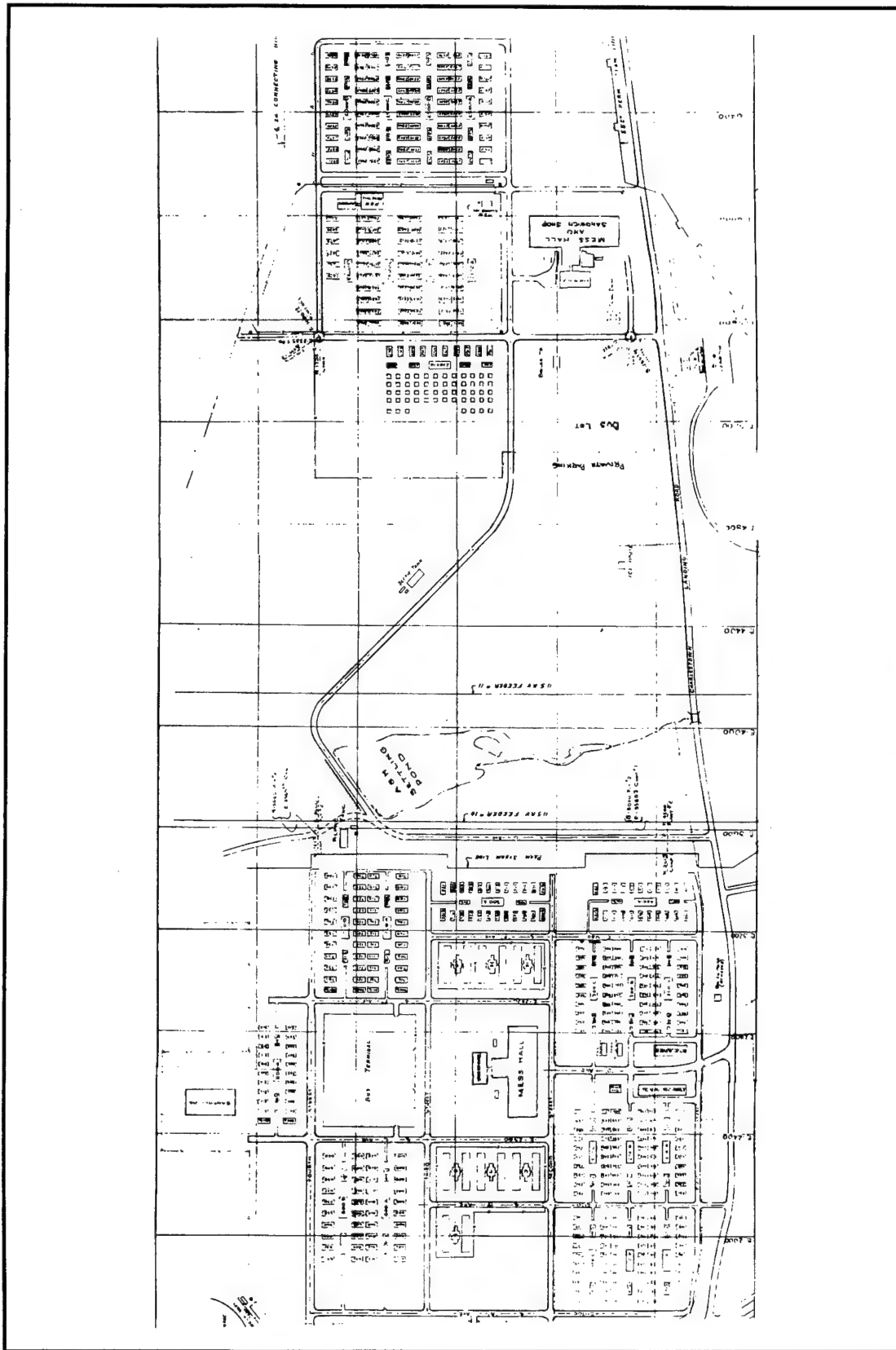


Table 9
Temporary Barracks for Indiana Ordnance Works Plant 2 Construction Workers

Type	Number	Size (m)	Number of beds
<u>Area A</u>			
Hobbs Hut	250	4.85 x 12.2	[10?]
Air Force Hut	124	6.1 x 14.6	13
<u>Area B</u>			
Hobbs Hut	20	4.85 x 12.2	[10?]
J.B. "Old Type" Military Hut*	66	6.1 x 14.6	21
J.B. "New Type" Military Hut	76	6.1 x 14.6	14
Air Force Hut	14	6.1 x 12.2	[10?]
Texas Hut	55	4.85 x 4.85	[5?]

Total sleeping capacity: approximately 7,175

* The POWs, who arrived in mid-1945, were all housed in these.

Source: Du Pont drawings C-129 and O-101 sheets 1 and 2, on file at INAAP.

Law Enforcement

As was discussed earlier, the boom period accompanying the first years of construction (1940 - 1942) lacked the usual increase in crime that was seen at other similar sites. There is evidence that this did not hold true throughout the war in newspaper articles published after construction began on the rocket propellant plant, IOW #2. During 1941 and 1942 there were occasional reports of arrests, most for public intoxication. Articles concerning crime published during the latter half of 1944 and first half of 1945, however, reflect an increasing incidence of disorderly conduct, assault and battery, and even murder in the area. Those implicated were often men living in the workers camp at IOW #2.

An entry in a plant diary also provides insight into the changing face of Charlestown. One morning in the spring of 1945 a messenger named Albert Griffin quit his job but refused to turn in his pass, which prompted the commanding officer to have a Charlestown patrolman find Griffin and bring him to the office.

I [Colonel Lewis] told the boy that in view of his attitude of being absent yesterday during a time when we were so hardpressed for employees, and he was seen in the poolrooms, that I was led to believe that he was not altogether innocent in connection with packages having been reported received and not mailed at the Plant some time ago, as well as a registered letter which he signed for at the Post Office and which was addressed to one of the G.I. workmen on construction and who never did receive it. It has been reported to me from time to time that this Griffin boy chums around with a gang of youngsters in Charlestown. There has been considerable pillage and petty thievery in Charlestown, as well as some indication of white slavery cases. I told Griffin that I intended to report his case to the FBI and no doubt he would be investigated and would also be watched (IOW [1945]b:March 8).

There are several possible explanations for the change. The labor pool had been greatly diminished by this time, with many of the better construction workers moving into operations at various plants around the country and others joining the armed forces. Those left at this late date may have included a large percentage of individuals less concerned with maintaining social harmony and more intent on personal gain and the immediate satisfaction of emotional whims. The esprit de corps that seems to have reigned in Charlestown at the beginning of the defense effort would certainly have been flagging by that time as well, with the result that people were less inclined to put in the extra effort sometimes needed to get along. And cramped conditions in the workers' camp would not have helped matters either. A closer look at this change should reveal more about the diachronic forces at work under the sustained pressure of a boomtown environment. Charlestown would seem an ideal subject of such a study since the first stage of construction appears to contrast so greatly with the second.

Labor and the Labor Shortage

Even during the early months of operation at IOW #1 Du Pont had trouble finding skilled and semi-skilled persons for maintenance positions, most notably pipe fitters, electricians and machinists. The number of operations employees rose quickly--during May 1941 employment nearly doubled, going from 1,845 on the first to 3,195 at the end of the month--but local supplies of workers in the needed skills areas were drying up just as fast. Locating maintenance personnel was expected to be an ongoing problem. Chemists were also expected to be hard to find, so local universities were contacted and asked to forward the names of chemistry majors graduating that June (IOW [1942]c:May 30, 1941).

Employers outside of the munitions plants were having problems also, but as the manager of the local public employment office pointed out, there was a solution. He said there were many jobs paying \$40.00 to \$350.00 per month which he was unable to fill not because of a lack of applicants but because of employer prejudices. An "artificial" labor shortage was created because employers' "requirements as to age, race, sex and marital status are so strict." The manager added that only some, not nearly enough, employers were changing "by ceasing to discriminate against applicants because of race, color, creed, previous nationality, or lack of birth certificate" (CC 1941g).

Employers were also having trouble keeping the employees that did fit their hiring standards because pay at the plants was somewhat better. This competition also operated between government facilities in the area. Goodyear complained of problems keeping seamstresses, especially the ones who lived in Jeffersonville, because the Quartermaster Depot there was paying 52 cents an hour, whereas Goodyear only paid 40 cents (IOW [1945]a:March 7, 1942). This does not seem to have been too much of a problem for Goodyear, though, for the HOP facility was soon surpassing its production schedules by 200 percent and more. About 2,380 people were let go in March 1942 (INAAP [1963]:17), through no fault of their own: "All of these employees are so extra good it would be impossible to layoff for incompetence" (HOP [1944]a:March 23, 1942). The plant went to a five-day work week, in part to avoid firing more employees, but that caused a problem in that it did not offer remuneration well enough above prevailing wages to retain employees. HOP went back to a six-day work schedule on May 23 (HOP [1942]c:82).

A year after letters had been sent to area universities in search of chemists, there was still a decided shortage at IOW #1, and to add to the problem some of the recent graduates were using the plant as a ready stepping stone to something better. That something better was most likely more pay, perhaps more exciting work, but it could have also been draft deferment. During 1942, occupational deferments were on the rise as "a means of keeping skilled, irreplaceable workers in essential jobs and of drawing additional workers into such jobs" (Fairchild and Grossman 1959:174). Colonel Lewis felt chemists were particularly bad about using the plant as a means to such an end. To curb the high turnover, he issued an office order that they should not be released to other agencies nor presumably granted deferments (IOW [1945]a:May 23, 1942).

There was only one labor disagreement during 1942, which involved 16 cloth cutters at HOP, members of the Amalgamated Clothing Workers Local Number 87. An agreement was drawn up and signed by the interested parties on November 4, 1942, "without any work stoppage or man days lost" (HOP [1942]c:111).

Employment at IOW #1 hit its high on November 1, 1942, with 9,442 persons on the job, falling slowly thereafter. By December 1944 Du Pont had only 5,374 employees on their rolls (INAAP [1963]:10-11). The size of the work force at HOP fluctuated during the first years of operation, but steadily increased in the second half of 1943 and throughout 1944. In September 1943 HOP administrators were notified that their production schedule was to be increased considerably. Goodyear estimated that they would need 3,000 additional workers by the beginning of 1944, of which approximately 80 percent were expected to be women. The local office of the War Manpower Commission said they would do what they could but that Goodyear would for the most part have to provide for itself. As a first step, editors from all 29 newspapers in a 50-mile radius were invited on an inspection tour of the facility. All but two attended, and it turned out to be a public relations coup, the papers running 4- to 8-column headline articles with pictures.

Prior to release of these articles, interviews as a result of word of mouth . . . were comparatively few, numbering only 127 for the week of 23 September 1943. The week of 2 October, date when first release appeared in newspapers, number of interviews increased to 415. Week of 4 October, date of second release, interviews totaled 553. Increase continued the following two weeks, . . . numbering 632 and 643, respectively (HOP [1943]a:16-18).

Advertisements were also distributed that particularly targeted women (Figure 47). Through efforts like these, plant personnel at HOP battled high labor turnover and the work force continued to climb until it reached its peak March 20, 1945 (HOP [1944]a:October 20, 1944; INAAP [1963]:18).

Another employment difficulty was caused by the draft and, to a lesser extent, by the numbers volunteering for service. Men working in positions for which skilled labor was hard to locate would sometimes be deferred by the Selective Service if that position was considered essential to production. The Selective Service worked with IOW #1 and HOP in granting deferments to balance needs on the military fronts with needs on the industrial fronts (Figure 48). With presidential approval for an 11,000,000-man army by the end of 1943¹³ (Fairchild and Grossman 1959:52), however, there was pressure to begin drawing men from critical areas. The draft did not threaten too much impact on the plants at Charlestown until 1944. The Selective Service divided potential draftees into two groups of workers, those between the ages of 18 and 26, and those comprising the ages 27 through 37. Eight percent of the men belonged to the first group, "all of whom could be released shortly without jeopardizing the production schedule" (HOP [1944]a:March 1, 1944).¹⁴ The second group was called the critical group, and it encompassed 28 percent of the men, 114 of which were on the guard force. "The loss of these men to the Selective Service would tend to lower the Plant production, decrease the fire protection, lower the general operating efficiency of the Plant and increase the cost proportionately. In spite of all this, Mr. Child [Plant Superintendent at HOP] feels that the production schedule would be met. The manner of accomplishing it would be academic" (HOP [1944]a:March 1, 1944).

¹³ Earlier estimates were that "no more than 9,000,000 men would be available for the armed forces by 31 December 1943 and that 'mobilization of the nation to the ultimate degree' would make only 10,500,000 men available" (Fairchild and Grossman 1959:47--the quoted passages are the words of Paul V. McNutt, then head of the War Manpower Commission).

¹⁴ It is not clear whether these figures are for HOP only or also include IOW #1 since the plant diaries for both facilities were the responsibility of the commander of the entire complex, Colonel Lewis. Figures in a diary would sometimes cover both facilities. These figures are probably for HOP only. The percentages for IOW #1 were likely about the same.

ATTENTION!

Men & Women

**Here is An Opportunity to
Help in the War Effort**

Perhaps You Are Not Working 48 Hours or Not Engaged in An Essential War Industry

Goodyear Engineering Corp.

Operators of

HOOSIER ORDNANCE PLANT

Charlestown, Ind.

**Can employ a substantial number of persons -
Especially women - Including housewives -
Who are willing to work either full or part time -
On First, Second or Third Shifts**

Apply promptly at U. S. Employment Office

117 Federal Bldg., Jeffersonville, Ind.

- 147 E. Spring St., New Albany, Ind.

Figure 47. Help wanted advertisement for Hoosier Ordnance Plant, 1943 (HOP [1943]b).

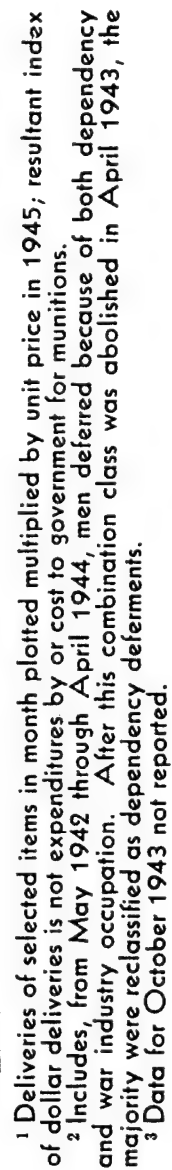


Figure 48. Nationwide munitions production and industrial deferments, January 1942 to August 1945 (Fairchild and Grossman 1959).

Child's estimates may have been wrong. Five months later IOW #1 was approximately four percent behind schedule and Hoosier three percent behind. Whether this was due to labor shortages or not is arguable. Colonel Lewis told the War Production Board that he felt it was more due to the erratic nature of their current scheduling which upset planning at the two facilities--"the situation is not serious" (IOW [1945]a:August 10, 1944).

The situation at the plants may not have been serious at that time, but it was growing worse, and Kentucky Federation of Labor Secretary E. H. Weyler believed that the deciding powers were ignoring sources of labor for the plants and for other businesses that could have at least temporarily solved the shortage. Weyler believed that tenant farmers were not being fully utilized in the off seasons. Employing labor from this sector was discouraged because it had to be approved by county agents and boards, which "practically reduces tenants and [share]croppers to the condition of serfs" (du Pont 1944:n.p.).

By the beginning of 1945 the labor shortage was adversely affecting production at the plants and an extensive recruiting program was begun to supplement the efforts of the United States Employment Service and the local War Manpower Commission. The Personnel Division visited towns across southern Indiana and northern Kentucky to search out prospective employees.

Women in the Work Force

At the end of 1941 there were approximately seven million men and women working in defense production nationwide. Ten million more were needed. During 1941 and much of 1942, little had been done to specifically target women in hiring campaigns. But this labor force, a pool of 36 million potential workers, stood to be an enormous source of labor, and hiring practices eventually took the fact into consideration (Anonymous n.d.g:10; Fairchild and Grossman 1959:169).

In a 1942 survey, the Women's Bureau of the U. S. Department of Labor found that, compared to men, women were at least as well if not better adapted to the types of production and assembly work most war materiel concerns were engaged in, especially "work that required a great degree of finger dexterity. . . . The theory that women have no mechanical aptitudes was exploded in the first World War; and there was every reason to believe that they were capable of even greater contributions in this war" (Anonymous n.d.g:10-11). Their work at the Charlestown plants proved no exception. One IOW #1 employee recalled that in the end they were doing everything from driving trucks and pushing carts to production work. And since their fingers were more nimble they could "cut the powder" better than men (Hock, interview 1994).

The likelihood of there being a great number of women employed at HOP even influenced the design. Since Shreve, Anderson and Walker had noted that Indiana law prohibited women from working more than two shifts, the size of the bag manufacturing building may have been increased to accommodate more employees (HOP [1942]a:January 20, 1941). Although consideration was given to the employment of the greatest number of women, planners did not consider how those from the Falls Cities would get to those jobs--no women were allowed on the trains bringing employees to the plant ([Old Timer] 1941a).

As the work force increased in the first three months of operation at HOP, legal aspects of using women in manufacturing were questioned. According to one judge who had jurisdiction over the area, an Indiana statue prohibited women from working in manufacturing between the hours of 6:00 pm and midnight. As long as it was not during those hours, women could be worked on two shifts six days a week. The judge did not consider the load lines to be manufacturing and stated that women could be employed on three shifts there. And if he could not get written approval on the matter from Washington, he felt he could get what amounted to the same from the Attorney General's Office (HOP [1942]a:November 7, 1941).

It was rarer for women to work on the night shift at IOW #1. As the draft took more and more of the men from the production lines, the men that were left took on an increasing amount of work. "The general policy of this plant [IOW #1] was to avoid having female workers on night duty. . . . During the construction period . . . several men and women took advantage of being in a secluded spot on the plant during night shift; . . . many necking parties resulted, necessitating the discharge of the guilty persons. My present policy is to try to avoid the recurrence of similar actions" (IOW [1945]a:May 8, 1942). This policy, similar in nature to recent arguments concerning women serving in the armed forces, had to be altered as the war continued to reduce the traditional labor pool.

Some jobs, whether night or day shift, were exclusively in the male domain at the beginning of operations. One such job was performed in the cutting houses, but on August 3, 1942, the first female powder cutter was hired. By the end of the year there were 384 female employees at work in manufacturing areas at IOW #1, and many more employed in the various laboratories at the facility (IOW [1942]b:72).

As demand for female employees increased and hiring practices encroached on what some considered traditionally male work, the different ideas about wages at the two plants became evident. Goodyear complained that Du Pont's higher pay for female employees caused women working at HOP to want to switch employers. There was justification for some pay differences because the work environments were classified differently--IOW #1 was an explosives plant, and thus the wage rates were set by the Walsh-Healy Act; HOP was not then so classified, therefore wages at that facility followed the prevailing rates or were covered by the Fair Labor Standards Act. But this was not the crux of the problem.

Goodyear divided some jobs into subclasses of light and heavy work. There were, for example, light work janitors and heavy work janitors. Females were assigned to the former and males to the latter, with pay ostensibly being set according to the amount of work involved. The maximum hourly rate for women employees at HOP was 60 cents.

Du Pont, on the other hand, determined pay by a 17-point job analysis, which evaluated functions rather than individuals. Under this system, male or female, janitors were classified as janitors. The Walsh-Healy Act set the minimum wage for explosive plants at 57.5 cents per hour, which Du Pont upped to 64 cents. Gender differences did sometimes show up in these evaluations, however. Women who had only recently been hired in powder cutting were paid 72 to 81 cents per hour, whereas men there were paid up to 90 cents. Du Pont said the difference was justified because of a specific difference in job descriptions, which did not require women to lift powder and place it into the machines (IOW [1945]a:August 12, 1942).

The conflicting pay rates for janitors was apparently solved when Du Pont changed its classification to Change House Attendants and it seems lowered the pay as well. This appears to have been the only concession Du Pont made since Ordnance gave approval of the pay scales at IOW #1 and told the administration at HOP that if the conflict went to the Secretary of War, Goodyear was likely to lose (HOP [1944]a:August 27, 1942).

Unlike Shreve, Anderson and Walker, Du Pont had not designed its facility with the employment of women in mind, and so had to make changes as they hired more women in more areas of production. Until the last quarter of 1942, the lack of change house facilities had limited the placement of women to only a few areas. One new change house was constructed and several men's change houses were remodeled so female labor could be utilized on a wider scale (IOW [1942]c:27). Other changes involved smaller efforts, such as the replacement of heavy doors with lighter ones on powder transfer carts. By the end of September 1943, when the Falls Cities Womanpower Committee of the War Manpower Commission visited war industries in the area to observe women on the job and determine how they could best bring other women into the work force, every department and all phases of powder production at IOW #1 involved female employees. All production jobs initially considered unsuitable for females had been "re-engineered so that they might be handled by women" (IOW [1943]:21-22).

One of the last areas to be opened to women was maintenance. One IOW #1 supervisor even said that women worked in every department except maintenance (Howard, interview 1994). However, the first two female Maintenance Department employees were hired on November 7, 1944. Although no figures showing early percentages have been located, those in Table 10 show that at the end of 1943 women made up about 20 percent of the work force at IOW #1. By November 7, the first day women occupied positions in every production department at IOW #1, almost 30 percent of the work force there was female. The figure was close to 50 percent at HOP.

Table 10
Male and Female Employees at IOW #1 and HOP

	<u>Indiana Ordnance Works</u>		<u>Hoosier Ordnance Plant</u>	
	male	female	male	female
December 31, 1943*	4,869	1,280	--	--
March 1944**	4,502	1,179	--	--
June 1944***	4,088	1,214	--	--
September 1944****	3,986	1,543	--	--
August 11, 1944*****	4,174	1,614	2,447	5,152
August 29, 1944*****	4,083	1,576	--	--

Note: This table lists all the employee totals found during research which list male and female separately.

Sources: *War Department Industrial Facilities Inventory, Indiana Ordnance Works, Charlestown, Indiana. Vol. I. U.S. Engineer Office, Louisville, Kentucky. June 1944.
 **History of Indiana Ordnance Works, First Quarter - 1944.
 ***History of Indiana Ordnance Works, Second Quarter - 1944.
 ****History of Indiana Ordnance Works, Third Quarter - 1944.
 *****Plant Diary IOW 2:August 11, 1944
 *****Plant Diary IOW 2:August 29, 1944

The reasons women went to work at the facilities were dual--they could earn more money and they could help the war effort. Christine Richey jumped at the chance because the pay was twice what she had been earning in Louisville (Richey, interview 1994). Others saw a good opportunity to save for their children's educations (Howard, interview 1994). But there is no clear indication of whether a majority of women would have sought other employment opportunities had the situation in Charlestown been different. Without the extra incentive of doing something for the war effort, many mothers would probably not have taken on the extra responsibilities of working outside the home. Day care facilities were not provided at the Charlestown plants to help working mothers, and it is doubtful they would have been made available at other places.

African-Americans in the Labor Force

Production pressures and the labor shortage opened opportunities for African-Americans as well, although much less than they did for women. Just prior to World War II, approximately 3.5 percent of Indiana's population was of African-American descent. Blacks in Charlestown, as in much of the rural United States, were far from integrated in mainstream community life. Most lived on the south side of Charlestown in an area locals referred to as "Nigger Hill" (Richey, interview 1994). Integrating this population into the production effort at Charlestown posed more problems than did integrating women. White women were

viewed as extensions of their husbands--the government made efforts to woo prospective female workers "who might be persuaded to take their husbands' places in the war effort" (McManus 1979:12)--or of the white male worker in general. The black segment of the potential labor pool, however, was seen as a separate entity altogether. And at least in the beginning was treated as such at the Charlestown plants.

On the state level, a Bi-Racial Committee of 16 prominent African-American leaders was set up by Governor Henry F. Schricker in June 1941. Two of the 16, Charles Grundy and Reverend J. O. Clark, had residences in Jeffersonville. The committee members were to work with a committee of industrial leaders from the State Chamber of Commerce to bring more blacks into defense production. The governor also appointed two African-Americans to prominent positions in defense planning--Dr. Theodore Cable was appointed to the State Advisory Defense Council and J. Chester Allen was made "Co-ordinator of Negro activities in the defense program." Local biracial committees were set up in 21 Indiana cities to work with local labor union representatives and increase employment opportunities for blacks. Eight months after the biracial plan was set up unemployment among blacks was down from nearly 54 percent to less than 20 percent. The biracial committees also worked to encourage better housing for black communities, make available more technical training opportunities, and develop educational programs dealing with health, recreation and juvenile delinquency (Indiana War History Commission n.d.:500).

Part of the impetus for the formation of this committee may have come from Charlestown. Two months prior to the governor's action the executive secretary of the National Association for the Advancement of Colored People visited Jeffersonville in response to accusations that "Negroes were refused employment on the two projects regardless of their skill and less-experienced white men were given the jobs." They were to file suit within a few days. They also announced a committee had been formed to look into the threatened eviction of blacks from their homes to make way for a new housing project (LT 1941b).

Area labor representatives reported the situation to the National Youth Administration, complaining that blacks were not receiving training from Goodyear that would enable them to work in bag manufacturing, nor were they receiving similar training from shirt and clothing manufacturing concerns that would allow them to take the place of employees leaving those enterprises to work at HOP. This prompted Judge Lorenzo K. Wood of Louisville to call the commanding officer to inquire about "trouble" there. He was told that there were no complaints (IOW [1941]:May 12, 1941).

The state committee and local labor complaints appear to have had a positive effect on the situation in Charlestown, at least as far as job opportunities were concerned. One month after the formation of the committee, when the first group of women began training for jobs in bag manufacturing, the local newspaper reported that one of the three shifts in bag production would be for blacks only (CC 1941h). However, there is no record that this plan was actually put into effect.

At the national level, little was done until the latter half of the year. The Army position on racial integration was that if it would in any way slow production, the hiring of blacks should be avoided--"Wait until after V-E Day to reform the world" (words of a high-ranking Army Service Forces officer as quoted in Fairchild and Grossman 1959:173). President Roosevelt felt this stance needed modification, and on July 25, 1941, acted on the recommendations of the LaGuardia committee¹⁵ and issued an executive order meant to end discrimination against war industry workers on the basis of race, creed, color or national origin. The president reemphasized the order in September by sending out press releases urging "all Government departments and agencies to take immediate steps toward eliminating discrimination, particularly against Negroes, in the Federal civil service" (IOW [1942]a:newspaper clipping attached to September 6, 1941, entry).

¹⁵ The committee, headed by New York mayor Fiorello H. LaGuardia, was formed in response to the grievances of a number of African-American rights groups. The committee proposed "forbidding discrimination in war industry and requiring government contracts to bear a nondiscrimination clause" (Fairchild and Grossman 1959:158).

Although lip service was paid to equality, it was not until after the first tension of the labor shortage was being felt nearly a year later that blacks were hired for any positions outside janitorial or unskilled labor areas at IOW #1. By the end of 1942 there were 876 male African-Americans on their payroll--"18 were chemists on the weekly salary roll, and 28 were janitors, the balance being employed as laborers, operators in the blending and final wringing in the Nitrocellulose Area, and in packing in the Finished Stage Area" (IOW [1942]b:72).

Informants interviewed in the course of research differed greatly in their recollections of African-Americans working at the two Charlestown plants. Numbers ranged from none (Payne and Payne, interview 1994) to many, especially during construction (Howard, interview 1994). All said there was little or no segregation, although there seems to have been separate toilet facilities at one time (Potter, interview 1994). As with women, few data were found showing the numbers or percentages of blacks in the work force (Table 11). One reason for this may be traced to the War Department's efforts to reduce discrimination following President Roosevelt's executive order: "The personnel offices of contractors and government arsenals were notified to delete any mention of race or religion from job application forms" (Fairchild and Grossman 1959:159). This may have been extended to the keeping of records, but the fact that some data are still extant indicates such records were kept at the facilities, records which future research efforts may be able to locate.

Table 11
Euro-American and African-American Employees at Indiana Ordnance Works

	Euro-American	African-American
December 31, 1943*	5,608	541
March 1944**	5,186	495
June 1944***	4,847	455
September 1944****	4,950	579

Note: This table lists all the employee totals found during research which list racial differences and which are not included in the text.

Sources: *War Department Industrial Facilities Inventory, Indiana Ordnance Works, Charlestown, Indiana. Vol. I. U.S. Engineer Office, Louisville, Kentucky. June 1944.

**History of Indiana Ordnance Works, First Quarter - 1944.

***History of Indiana Ordnance Works, Second Quarter - 1944.

****History of Indiana Ordnance Works, Third Quarter - 1944.

Other Nationals and POWs in the Labor Force

As the labor pool continued to evaporate in the heat of front line needs, German and Italian war prisoners interned in the United States became an increasingly attractive source of workers. There were less than 3,000 POWs on the west side of the Atlantic at the end of March 1943, but by June of the next year their numbers had grown to 196,948. In the spring of 1943 the Provost Marshal General allowed POWs to begin working for private interests, doing primarily agricultural work. Their usage gradually widened to other areas, but "security problems, international law, public distrust, and strong opposition from the labor unions" hampered efforts to place them in industry (Fairchild and Grossman 1959:189-193,256; Lewis 1988:102-106, 144).

By late 1944 many POWs were employed in military institutions, even though doing so was arguably in violation of the Geneva Convention. And the regional director of the War Manpower Commission urged

the wider use of war prisoners in the Indiana region (IOW [1945]a:December 18, 1944, article from the *Louisville Times* attached to the entry for the same date). But if the commanding officer or contractors were considering alternative sources of labor it seems POWs were not at the top of the list. Instead it was labor from the West Indian island of Barbados. One newspaper reported that "Army engineers and du Pont [*sic*] officials . . . suggested that a recruiting force be sent to the Antilles to round up Negro labor" for use in construction at the rocket plant, IOW #2 (LT 1945). Two days later, another article reported that the Army and Du Pont officials had decided that plan was not feasible and that Army plans to "work Nazi prisoners" had brought about a three-way deadlock involving the Army, War Production Board, and union officials (LC-J 1945). There is, however, no evidence in IOW records that Barbados Islanders were being considered to augment the construction forces or that there was a problem of unusual proportions between the three parties noted to be "deadlocked" in the article.

The use of POWs was discussed in December 1944 during a visit to the plant by officials with the Corps of Engineers. But a telephone conversation between Colonel Lewis and a Major Lebron, in the office of the Field Director of Ammunition Plants, indicates that they thought the POWs would be more trouble than they were worth.

Lewis: . . . The operating contractor says he's not going to be satisfied unless he puts adequate number of guards on there with a thousand damn Germans next to him. . . . Right here at Jeff Depot [the Quartermaster Depot at Jeffersonville, where they thought the POWs would be housed] next door to us . . . the Army there is very complacent with them. Those prisoners are walking all through the offices, unescorted, and so on.

Lebron: Well, that seems to be the attitude they're taking at these other places too. But we'll have to tighten up on them on that. . . .

Lewis: However, we'll cross those fences when we come to them, or if we come to them and we'll just have to stay on our toes and hope that none climb our fences etc.

Lebron: We just hope that--our attitude is here that they'll not use them unless it's absolutely essential. . . .

Lewis: Well, that's our feeling here, but the C of E, they talked prisoners the minute they landed here. . . .

Lewis: See Major Carnes [at the Zone Transportation Office] . . . wanted to know if they could use our inter-plant busses to haul those fellows between the work site and the QM Depot.

Lebron: I know it's in your letter, where you explained to him that those busses were on shift and the workers would be coming and going at the same time.

Lewis: That's right. And he said that it would be up to the construction people to switch their shifts, and I . . . told him as I saw it they would either have to work after dark, which they were not permitted to do, or work between 9:00 and 3:30. Well, it'll take them an hour to go each way and an hour for lunch and that wouldn't leave very much time.

Lebron: Just be giving those boys a bussy [*sic*] ride.

Lewis: That's all you would do (HOP [1944]a:December 29, 1944).

In May 1945 the decision to send 1,000 German prisoners of war to supplement the construction forces at work on IOW #2 was made, and it was determined they would be housed at Labor Camp Number 2 (Figure 49; see also Figure 46).¹⁶ Plans to reduce the guard force at the facility were postponed and more guards were moved to the camp area (IOW [1945]b:May 8). The areas in which the POWs would be working were established and plans were made to remove all other labor from those areas during the times the prisoners were on the job. Little trouble was expected since "these particular PWs [*sic*] had been in this country for a considerable length of time working on similar projects and many of them were English speaking" (IOW [1945]b:May 18).

¹⁶ The POW camp, Block Number 2400 of Camp 2, had guard towers at each corner and contained 66 barracks labeled on Du Pont's Drawing Number C-101, Sheet 2, as J.B. "Old Type" huts. There were four bath houses and a Mess Hall in the block, and each of the 6.1 m by 14.7 m (20 ft .25 in by 48 ft 3 in) structures contained 21 beds.

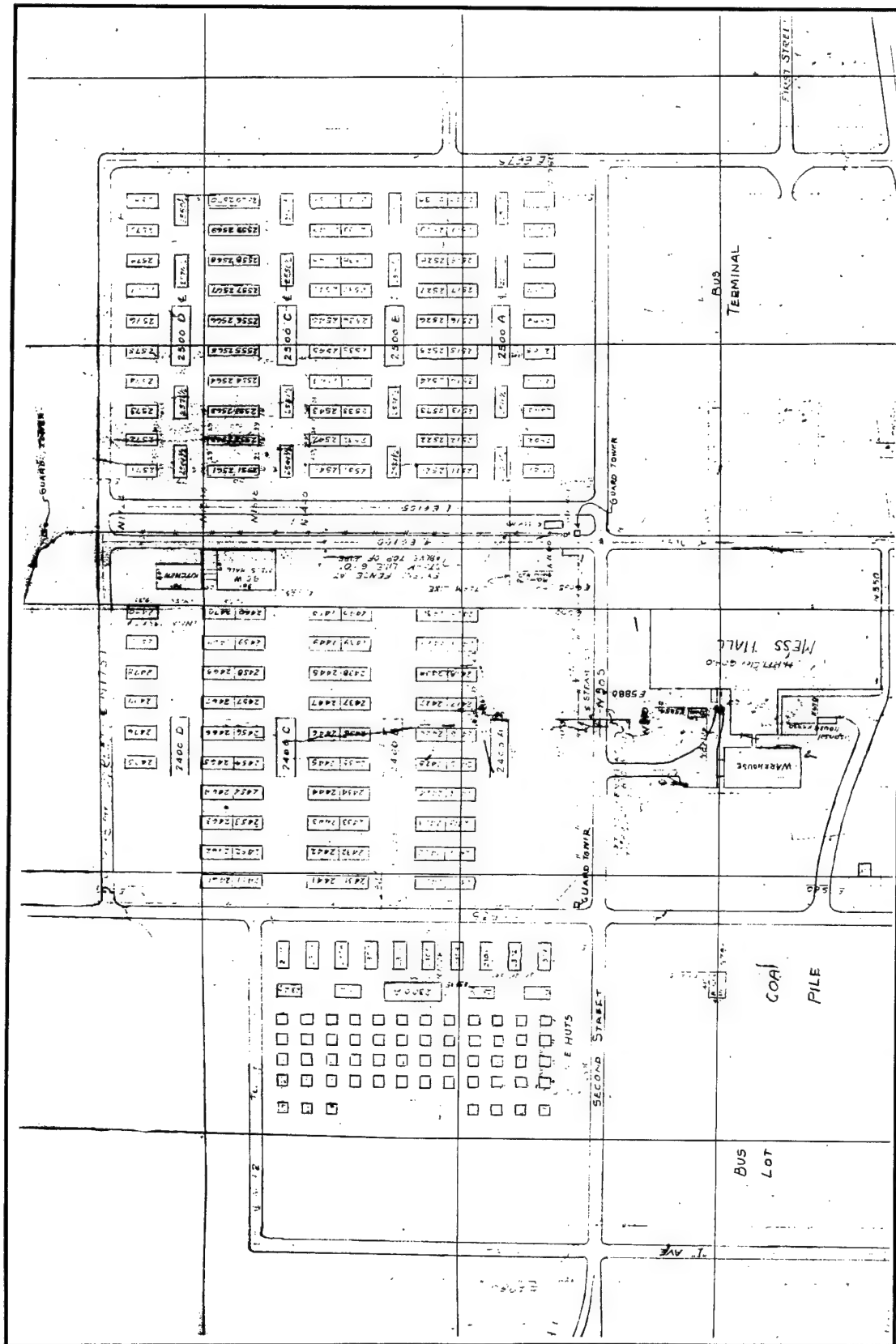


Figure 49. Area 2 of the Workers' Camp for Indiana Ordnance Works Plant 2 construction employees. The POW camp is in the middle, with guard towers at each corner (INAAAP Drawing C-101, Sheet 2).

The first 500 POWs arrived just before noon on May 19 by train from Camp Joseph T. Robinson, Arkansas. They disembarked at the Charlestown depot and were escorted directly across Highway 62 to the camp area, perhaps first going through a "Disinfestation Building" shown on Du Pont Drawing Number C-129 (see Figure 46). "There were no unusual incidents . . . and an unusually small number of spectators, except those from the Administration Building and the Plant Cafeteria" (IOW [1945]b:May 19). The second group of 500, from Camp Swift, Texas, arrived early the next morning and disembarked at the same location, again with no unusual incidents (IOW [1945]b:May 20). According to an interview with Kelly Lewis in 1973, these POWs were all part of Rommel's Afrika Corps (Flynn 1973:A9).

Although the historical record states that the POWs primarily dug ditches and filled in ditches around buildings, they may have done other construction work as well. One photograph shows POWs beside the foundation for a Machining House (Figure 50). Since no other workers were supposed to be in areas where POWs were working, all the men in the photograph may be POWs, in which case they were definitely doing construction work. Although it is difficult to see in the reproduction, the original photograph shows one shirt with "PW" stenciled on it. (Note that no armed guards are visible in the photograph, in spite of what had been said about keeping the prisoners under strict surveillance.)

Having the POWs work more extensively in construction--for example, by having them clean lumber stored at HOP--was at least considered after the commanding officer was informed that German POWs were putting fuses in shells at Radford Ordnance Works in Virginia. Even though that would have been clearly in violation of Geneva Convention guidelines, Colonel Lewis called Radford to find out how prisoners there were being put to use. As it turned out, they were unloading cars in the explosives area, still possibly violating the guidelines. But security was of more concern to Colonel Lewis. The guards at Radford had been doubled and towers surrounding the areas had been activated. He decided not to make any changes (IOW [1945]b:June 5).

The POWs were at the plant for less than three months, being quickly repatriated after V-J Day.

Everyday Life at the Plants

"Wishing Won't Win . . . Work!"

Whether it was in construction or operations, the motto of both plants was simply "Work." This was elaborated slightly in the above, the official slogan for the Du Pont factory that adorned the cover of most issues of the company paper, the *Powder Horn*. Work to get materials where they should be when they should be. Work to get construction wrapped up so the real work could begin. Work to meet the schedule. Work to supply the front lines. Work to win a war. Work for peace. And, true to the Modernist Ideal, this ethic did not end at the factory gate but extended into the home.

Munitions manufacturing at Charlestown was an effort conducted in the best interests of the nation and at the behest of the federal government. But it was also a business interest, undertaken by private concerns with profit in mind. Neither Du Pont nor Goodyear would have undertaken, nor would have been able to undertake such an endeavor at a loss. The search for profit, for the creation of a greater amount of surplus value, involved not just dedication to a task. This is aptly expressed in the credo of the day in architecture, form should follow function--the exterior should reflect the purpose. To be a more perfectly functioning machine, the worker's life off the plant should also follow his function in the facility. This harks back to Henry Ford's Sociological Department initiated in 1914, which developed profiles of all employees that covered "their biography, the economic and financial situation of themselves and their family, along with portraits of their morality, habits, and lifestyle" (Smith 1993:48-49). The unusual nature of the defense effort gave GOCO operators a unique effort to promote a work-and-life ethic under the guise of national

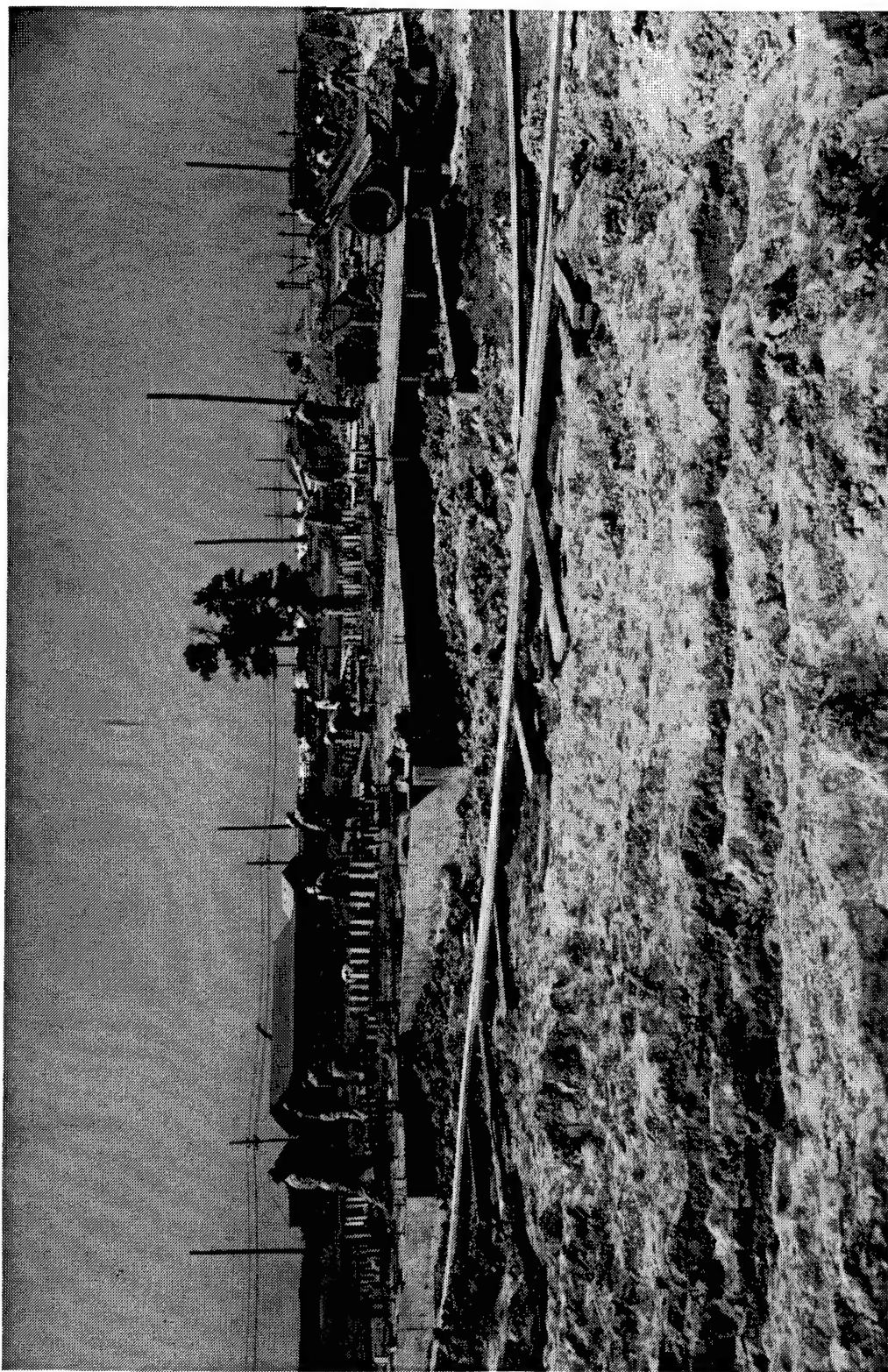


Figure 50. German POWs helped, at least to some degree, with construction at Indiana Ordnance Works Plant 2. The group in the right background, wearing shirts with "PW" stenciled on them, are definitely POWs; others pictured may also be prisoners (photo courtesy INAAP).

pride and honor, although the labor shortage prevented them from making personnel adjustments according to their findings.

"Joe Smith," a fictional "production soldier" in the pages of the *Powder Horn*, set the example. He had gotten married in the early 1930s, had two children by the time he went to work for Du Pont, and took the Du Pont physical (which included tests for syphilis to ensure he was not carrying any vestiges of an abnormal sex life that might affect his work). He bought defense bonds, cut out unnecessary pleasures, paid his taxes. His two brothers were in the service; his sister taught school, "molding future generations of free Americans. All in all, the Smith family exemplifies what we are working and fighting for" (Griffo 1942). That these were worthwhile aspirations no one would deny, but one should also keep in mind that they come from a very successful business enterprise with a vested interest in promoting this type of laborer. It could be suggested that future research make an effort to evaluate the impact on production of the promotion of the ideal citizen in a time of such wholehearted national fervor.

Safety and Security

The safety of the workers was perhaps the top priority at both plants, as can easily be seen by even a cursory look through the plant publications. All publications (Du Pont had *The Action*, later replaced by the *Powder Horn*, and Goodyear had the *Hoosier Clan*) contained safety articles and 'tips' in every issue. Safety awards were presented regularly in all departments amid heavy publicity.

During construction in 1941, Du Pont set a world construction industry record for injury free hours--3,650,000. In the nine million hours worked to that date, there had been only one serious accident (Anonymous n.d.h).

In Allen Hugh's *The House of Goodyear*, a long section is devoted to safety measures at HOP, reflecting the emphasis that the contractor placed on the prevention of accidents.

Safety was everywhere pervasive, starting with the original layout. The loading booths had but one door which opened outward. There was no communication between booths, and escape chutes were installed on the second floor so that employees could slide down to safety. The roofs of all buildings were almost tacked on. Powder explodes upward, and the roof must offer no resistance. Conductive shoes were issued to everyone who entered the explosive area, so that any static which built up on his body was dissipated into the soles, and from there into the ground by conductive flooring. Employees loading black powder wore transparent, shatter-proof, plastic shields to protect their faces (Hugh 1949:544).

Hugh also noted there were systems for detecting electrical storms that would automatically sound an alarm if a dangerous amount of static electricity accumulated in the atmosphere. And powder distribution in the storage areas and along the lines was regulated so that there would be no surplus. If a storm put a stop to operations, the powder was sent back to the igloos. But the most important precaution to Hugh was the Change House.

Every person who went into the explosive area had to pass through it. Workmen had two lockers, one on the "inert" side of the building, and one on the "explosive" side. He took off his clothes on one side, passed over to the other, found his uniform waiting there. There were no pockets in it, no chance to hide a match or cigaret [sic]. Women employees had the same arrangement on their side of the building (Hugh 1949:544).

The laundry was also a safety measure. Uniforms for those working on the LAP lines were washed at least three times a week, and those of the black powder workers were white, which made even the smallest amount of powder dust visible (Hugh 1949:539). IOW had similar precautions, even full body rubber acid

suits. When a flange on a strong nitric acid line broke, spraying W. R. Hefferman, he received only a slight burn on the left side of his face (*Powder Horn* [PH] 1943).

But the most important safety measure at a powder plant of course was matches, and there was an extensive campaign to inform employees of the regulations and to alert them of the dangers of carrying these onto the plant (Figure 51). Penalties varied over time, but the first offense usually resulted in a one- or two-day suspension, the third offense could mean loss of a job. Everyone was checked before clocking in, and it seems a lot of people were caught, not always through any fault of their own, says Julius Hock, who worked in the safety department. He believes people would plant matches on others at times, perhaps maliciously but also because they just had to get rid of them somewhere (Hock, interview 1994).

The health of the employees was also closely monitored. Intensive examinations were given as part of the hiring process (Hinds 1942), sometimes by three or more doctors (McVicker, interview 1994). And employees continued to have physical examinations at least once a year. Workers in the DNT production area at IOW #1 were examined each month; those in the DPA area every six months. Pregnant females were removed from positions where they could be exposed to toxic chemicals. And leaves of absence for medical reasons had to be cleared through the Medical Division, as did the return to the job (INAAP n.d.:7-8).

All the precautions resulted in an extremely good safety record at both plants, in spite of local fears about the dangers of working there (Richey, interview 1994). The worst accident occurred in the summer of 1944, when a fire in one of the blending towers killed three and injured two, one seriously (IOW [1945]a:August 13, 1944).

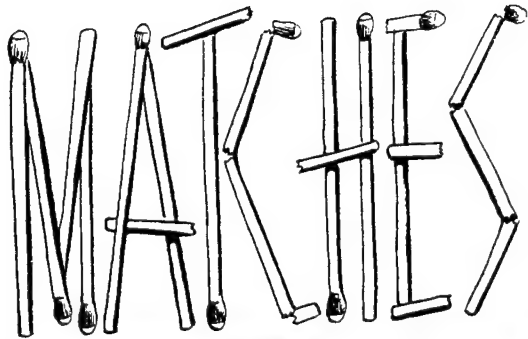
Security was also a major concern in the area. Even lunch boxes were dropped off before entering, to be inspected by guards and delivered later, and all operations employees were investigated to weed out possible saboteurs (Hugh 1949:543-544). Both construction and operations employees were fingerprinted, to the great misfortune of one man who left a whiskey bottle on a construction site. Prints from the bottle were matched with his employee records and the man was fired. The FBI had agents keeping tabs on the plant as well, and when one borrowed an ID badge and walked through the gate, three guards were fired (Flynn 1973:A1). But it appears such measures did not fail to stop the German spy Simon Emil Koedel from using his membership in the American Ordnance Association to get him through the gates of at least one of the plants (Farago 1971:493, 502).

The most visible aspect of security was the advertising campaign conducted in the plant newspapers that stressed the importance of keeping silent about work at the plants. Any information, it was stated, no matter how innocuous it seemed to employees, could be of use to enemy agents. The general rule was to not talk about anything that had not been in print or on the air waves (*The Hoosier Clan* [HC] 1943a). This message was carried all across Indiana in a month-long "Security of War Information" campaign in April 1943 promulgated by the Office of Civilian Defense (HC 1943b).

Ding dong bell,
Be careful what you tell.
Hostile ears may hear you speak.
Hostile hands may make us weak.
Ding dong bell (*[PH]* 1942).

Absenteeism and Turnover

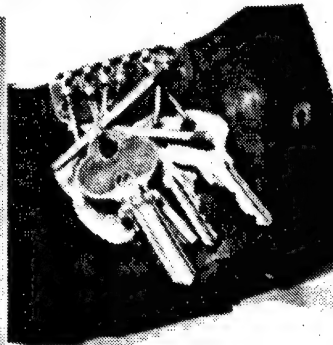
During the first years of the war, absenteeism and turnover were combated with appeals to workers' sense of responsibility, appeals which portrayed production on the industrial front as one of the most important factors in the war effort, determining whether front line forces were successful or not, whether troops lived



Match violations cause absenteeism. The following pictures were posed to show places to give that second check before coming into the plant. Carelessness is the chief cause of match violations. According to a survey made by the Patrol Division 54 per cent of the violators were found with kitchen matches, 23 per cent with box safety matches, 20 per cent with book safety matches and 3 per cent with lighters.



HAT. Many an employee has forgotten to look in his hat band. Look in yours before coming through the gate. Remember the recent Boston fire was caused by just one little match.



KEY CASE. It's entirely possible for matches to become entangled in a key case or wallet. Check everything in your pocket. Kitchen matches have a tendency to break off.



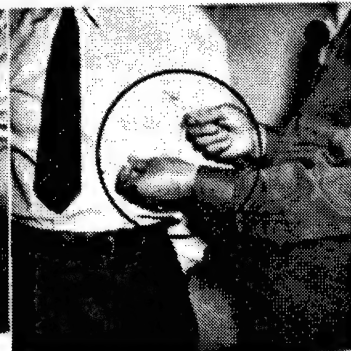
SWEATER AND JACKETS. That extra sweater you bring in to wear on cool nights or the one you don't usually wear results in 15 per cent of the Plant's violations. Look in the pockets.



PURSES. Matches in men's purses caused 4 per cent of the match violations here over a 10-day period. Women on the production line should check purses carefully both for back and loose matches before coming in.



TROUSER CUFFS. It couldn't happen ... The heck it couldn't ... 2 per cent of match violations are caused by matches found in trouser cuffs. Look in the cuffs ... just to make sure ... and in the pockets too.



SHIRT POCKETS. Shirt pockets yield matches to chalk up 21 per cent of the violations ... Coat pockets and watch and vest pockets also bring in 10 and 4 per cent, respectively, of the violations. We can be safe by checking twice.

Figure 51. Employees were searched for matches before entering the plants. Pictured is a page from the *Powder Horn*, Christmas 1942 issue. Violations were associated not only with safety but with absenteeism as well.

or died. Morale-boosting campaigns reiterated each individual's important role in the conflict. By 1944, managers had to also consider that "energies might flag as a result of rising optimism [that the war would soon end]. An increasing rate of turnover and absenteeism, the rising trend in the number of strikes, and the difficulty in enforcing manpower policies were considered symptomatic" (Fairchild and Grossman 1959:258).

Strikes were not a problem at the Charlestown plants, but absenteeism and turnover were. Programs in place as early as 1942 awarded areas with the lowest absenteeism rates for the week or the month, (for example, workers on the HOP load lines were awarded trophies each month) and the figures were published in the plant newspapers (*HC* 1942a). And individuals with outstanding attendance records were singled out and commended in articles in the plant publications.

These measures were effective in the beginning (*HC* n.d.), but by 1944 they seem to have been more defensive than offensive, carried out in an effort to keep things from getting worse rather than with the expectation of improvement.

Although comprehensive figures showing rates of absenteeism and turnover have not been located, the problem was likely at its height in 1945. Then, turnover at the IOW #2 construction site was as much as 50 percent per month, and plant officials said that "many of the workers get drunk and stay off the job for several days" (*LT* 1945).

Efficiency

Both the plants were highly efficient producers of materiel. IOW #1 operated at and above capacity throughout the war using a steadily decreasing number of employees, and the person hours required to produce charges at HOP at the end of the war was one fifth the number required when production began. HOP, though, seems to have gotten more credit for its production efforts than IOW #1. Although the following discussion mainly concerns the effort to improve efficiency at HOP, similar steps were certainly taken at IOW #1 as well. The difference may not lie in the actual events but in the types of records that were located for the two facilities. "Historical Reports" covering most of the operational history of HOP were located, but only the earliest of these was found for IOW #1.

In September 1942, HOP was notified that it was to receive an Army Navy Production Award (or "E" Award, which was a combination of the older Navy "E" and Army "A" awards). The reasons HOP received the tribute were several:

- (1) No charges produced here have been rejected since production began on September 2, 1941;
- (2) Every production schedule given this Plant by the War Department had been met on time;¹⁷
- (3) This plant had been selected to make ballistic samples and experimental charges formerly produced only at Picatinny Arsenal;
- (4) Problems which arise are solved efficiently and with apparent ease;
- (5) The Bag Manufacturing Division has obtained a 159 percent efficiency of War Department contract estimate; and
- (6) Bag Loading Division has obtained a 229 percent efficiency of War Department estimate (HOP [1942]c:112).

¹⁷ Note that, as related in the operations history of the facility in this report, production schedules in the beginning were not in fact met, showing the ceremony was in part a morale-boosting effort. Nevertheless, this does not discount the impressive production figures in the next items on this list.

The award was presented on October 5, 1942, in a heavily promoted 45-minute program held between shifts so the greatest number of employees could attend (HOP [1943]a:16-18). At the ceremony, the plant was presented with a large pennant with the letter "E" embroidered on it, which thereafter was flown in front of the Administration Building. Each employee was also given a lapel pin of the same design. Christine Richey attended the ceremony and was impressed. "They had a . . . special day and they put the big flag up that almost touched the ground--it was the most beautiful sight you ever saw." She was proud of the pin too, and in 1994 still had it (Richey, interview 1994). By the end of the war HOP was the only GOCO facility to win an "E" award during each year of production, picking up five in all.

One way the management of the facility speeded up production was by encouraging competition between the lines producing the same types of charges. "This was a material aid in obtaining increased production, and soon the actual production of the loading lines was well in excess of the designed capacity" (HOP [1942]c:76). By the end of January 1942 all eight lines were operating two shifts six days a week. This spirit of competition between different lines and the two shifts of the same line, along with several minor improvements in the manufacturing process, substantially increased efficiency, even with the addition of a great number of inexperienced personnel. "It was realized beforehand that January [1942] production would exceed the scheduled amount, but it was even better than anticipated" (HOP [1942]c:77). Production continued at such a high level that on March 9 Goodyear was informed that components would be provided for production no more than 20 percent in excess of scheduled amounts, and that personnel adjustments would be needed if production was expected to exceed that amount. Goodyear had to cut its 7,526-person work force by 2,378 and step down to a five-day work week to comply (HOP [1942]c:79-80).

This had its negative aspects as well, one of which was the amount of pressure put on the employees to perform. Women in bag manufacturing were told that

if anybody passes out and falls off their chair you don't stop, you keep on going. We'll take care of them. We have first aid people and they'll be here immediately. So even though you want to help, don't stop, just keep on going. . . . I don't think that they just stood over them with a stick or anything like that, but I mean they were paid according to how many they made.¹⁸ . . . They counted these bags, and however many that you could sew, then you would be given more money, and so they strived [*sic*] to try to do the best that they could (Richey, interview 1994).

One more element that affected efficiency was the on-plant transportation system. Thousands of employees had to be taken to and from their work stations, which could be as much as three miles away from the entrances. Both plants had their own buses and cars, operating on staggered schedules. At HOP, 34 buses and 100 cars would get employees to their posts within seven minutes of leaving the change house (Hugh 1949:542).

A Valuable Player in the War Effort

The two plants were unquestionably valuable in the defense production effort. The value was felt not only by the Americans but by Europeans as well. In the spring of 1942 the British Broadcasting Company included IOW #1 in a radio documentary entitled "Uncle Sam at War." The plant was the focus of the fourth program, called "Indiana Arsenal," which documented the migration of workers to the area and the changes the plant's coming brought to a rural American town (IOW [1945]a:March 2, 1942). Although no aspect of production, even what was produced, could be mentioned, the fact that the plant was chosen shows its eminence in the eyes of the British media.

¹⁸ No other indication that employees were paid by the piece has been located.

Soldiers' families would hang a "service flag" in their window, a rectangular piece of cloth with a silver star for each member who was overseas. The silver star was replaced with a gold star if the soldier was killed in action. To reinforce the feeling of the corporate family, a large service flag was hung in the bag manufacturing building at HOP, perhaps in other buildings as well, and there were probably similar flags at IOW #1. The first gold star was added in December 1942 for a private killed at Guadalcanal (Hackel, interview 1994; HC 1942b). Over 700 former employees of HOP had entered the service by the end of 1942.

Although it is extremely difficult to find specific examples of one facility's aid in the war effort, Allen Hugh does include one in his profile of HOP. The Germans had fortified Mount Casino, Italy, with long-range guns that were keeping the Allied Forces far enough away that the firepower they had was ineffective. The long-range 240-mm howitzer Ordnance had just brought into production was badly needed there, but ballistics tests showed no ammunition on hand would work effectively in the gun. HOP was chosen to develop the new charges. "Men and women volunteers worked day and night for 36 hours over a holiday to get out the order. . . . When the job was finished, the charges were rushed to the seaboard, and gun and Charlestown powder flown to Italy, went into action immediately" (Hugh 1949:547).

Production employees were made to feel they were important in the war effort in other ways as well. They were not just factory workers, they were soldiers on the industrial front (Figure 52). "You are a soldier in coveralls. . . a production soldier and the job before you will determine the winner of this war" (PH n.d.a). This same message was reiterated often in the newspapers, and in a Christmas 1942 telegram from General Douglas MacArthur: "We the soldiers on the firing line give thanks to you soldiers on the production line for the sinews of war that make victory possible" (HOP [1944]a:December 23, 1942). And toward the end of the war, when absenteeism was at its worst, soldiers from the front lines were sent to many plants, "personal emissaries of General Eisenhower," to give first hand accounts of the value of the production effort at home. The gun crew withdrawn from Germany that visited Charlestown talked to workers at their stations and between shifts, and even made a recording which was broadcast over the local radio station, WHAS. "They were enthusiastically received and it is believed that the message they brought will do much toward making people realize the importance of sticking to their jobs and doing their best in those jobs" (IOW [1945]a:December 4, 1944, December 7, 1944).

But at least as effective as such events orchestrated above were the smaller events that, even if they were prompted by their superior officers, held a personal touch. Such as the letter from Private First Class Fonda Fields to Building 105 in the nitrocellulose area dated December 15, 1944.

Hi Gang:

I guess this is a surprise to you to hear from me. Well I am the guy who use to run No. 11 Unit. Boy! I thought it was tough. But I will run 4 units if you will come over here & trade places with me. This goes to all of you fellows, I know how you feel working these 12 to 8 shifts. But sometimes I go for days without any sleep or rest. I can say one thing for the powder we made, I haven't seen one shell of ours fail to go off when expended, & I have seen half of the Germans' shells fall & not explode. I would have been dead if they should have exploded.

So boys and girls keep on the beam, and save lives by making more powder for our artillery, the more we have to throw at the Jerrys, the more of us are coming back to our love ones. Will you fellows please pass this on to others. It's tough and rugged over here, we work 14 days a week. So good luck to you all I wish you a Merry Christmas & new year. Your friend, Fonda Fields 10495 (IOW [1944]d:Exhibit 5).

And to make employees feel personally a part of the effort, both plants solicited suggestions from employees about how to improve production, sometimes giving awards for improvements that were particularly inventive or greatly aided production (Figure 53).

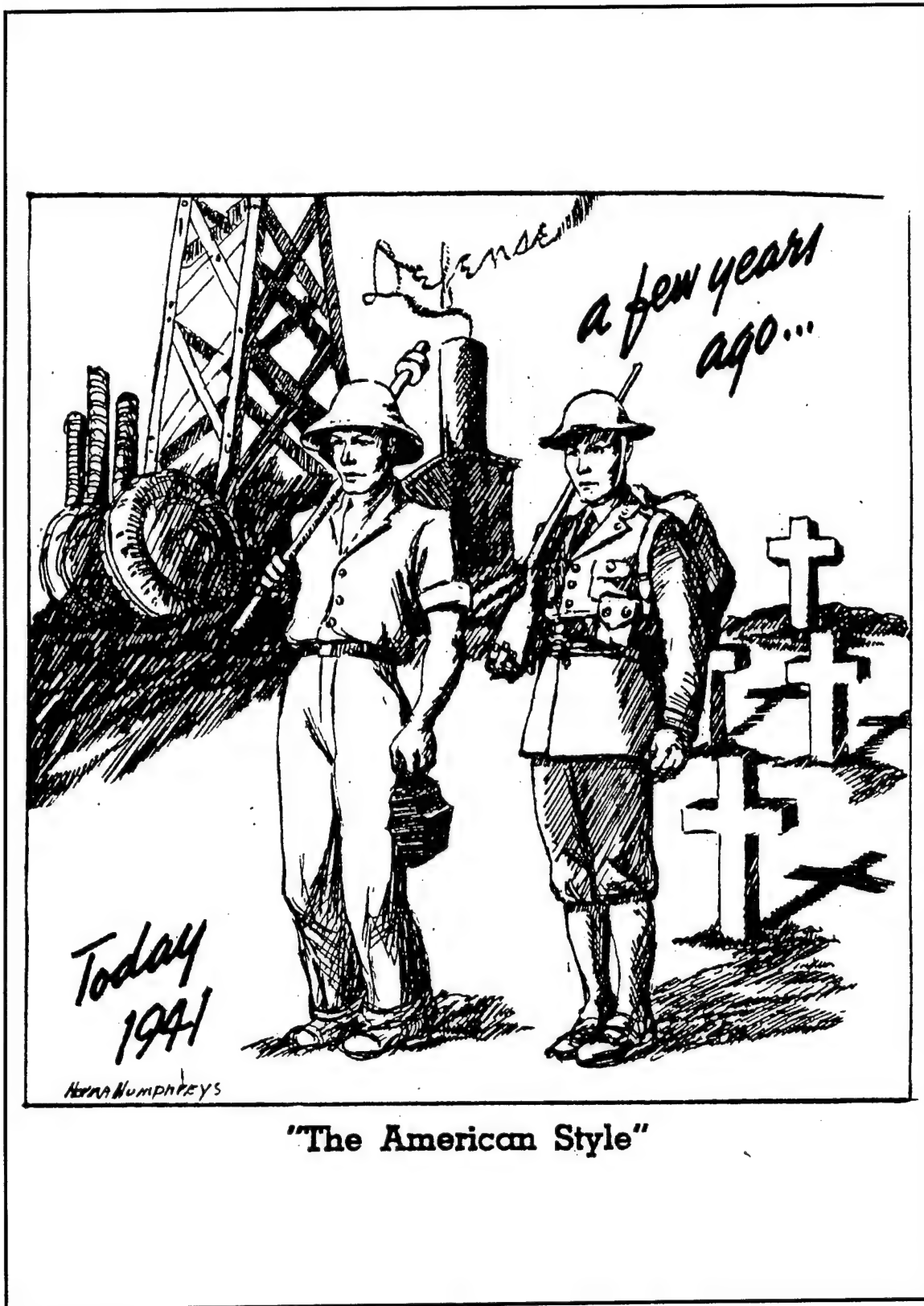


Figure 52. Defense workers at these and other munitions plants were portrayed as soldiers on the industrial front (Humphreys 1941a).

SUGGESTION ROUTE

You get an idea. . . You do something about it. You fill out a Suggestion blank and send it in. What happens to it?

The diagram illustrating this article clearly explains that.

Whether your idea is one that will help production, cut cost, make your job safer, or eliminate waste doesn't matter.

It goes to the same Central Suggestion Office. There it is investigated with copies of the idea going to the chief supervisor of the department where the suggestion if approved would be used, and to the chief superintendent of that department. Acknowledgment that you have sent in this idea is sent to you and to your senior supervisor.

And then, the decision! If the idea is put into effect, or if by some detail it isn't feasible, you are notified and thanked by the office. On your employment record is put down for all to see the fact that you are a thinking workman.

So this only goes to show that ideas for Uncle Sam help, and also bring recognition to the idea man. If you have one be sure and drop it in the Suggestion box today.

Oh. . . and incidentally if your idea is an unusually good one and is adopted you will probably see your picture and details of the plan in The Powder Horn.

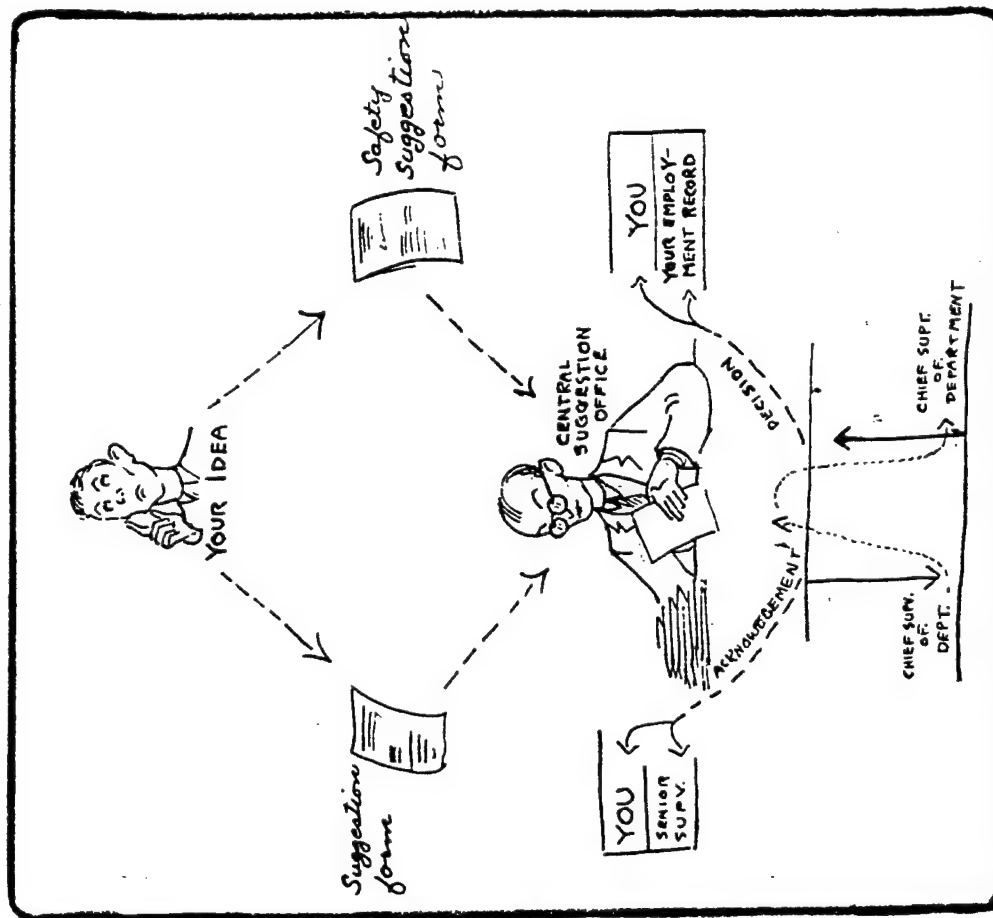


Figure 53. Employees at both plants were encouraged to make suggestions (Anonymous n.d.g).

Entertainment

The pressure to produce in the plants needed some balance of recreational possibilities away from the work station. There were a few social clubs, but most met in the mornings during the week and targeted local housewives.

Charlestown had only a few places for workers to entertain themselves. At the end of the war there seems to still have been only one bar and perhaps one movie house or theater (see Figure 4). There were many of these in the Falls Cities, only a short distance to the south though, as well as fine restaurants, gambling houses, and the daily dog races at Jeffersonville. One diversion at the plants was the arrival of the Goodyear blimp 'Reliance' at HOP. "The blimp was put at the disposal of the Commanding Officer for the purpose of a transportation and traffic survey as well as to afford various people an opportunity to obtain an aerial view of the Hoosier Ordnance Plant and the Indiana Ordnance Works" (HOP [1942]a:May 20 - 21, 1941). For two days in May 1941, the blimp flew over the two facilities carrying plant officials, army officers, and a few civilians.

There were, however, abundant sports activities at the plants for those who had both the inclination and the time to take part. HOP established a Recreational Association shortly after production started, although membership was confined to supervisory and office personnel (HOP [1942]a:October 20, 1941). At IOW #1 the government personnel at least thought about forming an employees club, on more egalitarian grounds, "in order that [a] closer and better relationship between the supervisory force and employees will prevail" (IOW [1941]:September 3, 1940). It is not known whether the club actually ever existed.

Whether these formal organizations set up by the upper echelon were actually responsible for the wide range of recreational activities or not, it seems that at neither plant was there a dearth of opportunity. Women from IOW #1 met Monday nights at the Madrid Bowling Alley (Humphreys 1941b), and there were other bowling leagues, golf tournaments, bridge games, touch football, softball--many different teams and leagues in different departments around the plants (*The Hoosier Clan*, and *The Powder Horn*, various).

The most popular sports were baseball and basketball. There were three baseball diamonds just on the IOW #1 grounds for the several hardball and softball leagues at the plant. During the 1943 baseball season there was a newly formed league of war plants, which had four teams in the Falls Cities area. The manager of the IOW team was Irvine "Irv" Jeffries, who had played with the Chicago White Sox, Cincinnati Reds, and Philadelphia Phils for 16 years, and there were at least 11 other players on the team who had played professionally or semi-professionally (PH 1943a, 1943b).

At least some sports were segregated. The Hoosier Bombers was an HOP blacks-only basketball team that competed in "Louisville's class A colored league." There were eight white basketball teams at the LAP facility that competed against each other. There was also a Wingfoot Girls' basketball team (*The Hoosier Clan*, various).

Environmental Legacy

The nature of the different manufacturing processes at the two original facilities at INAAP played a large role in determining environmental impact during World War II and thereafter. The environmental impact of the bag manufacturing and LAP facility beyond extensive disturbance to vegetation and faunal habitats has been limited to the effects of domestic waste discharged into the Ohio River, which was extensive during construction and periods of peak operations. All domestic waste was processed at sewage treatment facilities before being discharged into the river. Treatment of domestic sewage at the plant included "primary sedimentation, high rate filter, mechanical activated sludge and sludge digester, sludge bed, sludge storage, and chlorination of liquids flowing away from the disposal plant" (Stoner and Field [1942]:39).

The possible environmental effects of IOW #1 were greater and much more diverse. "Preliminary estimates indicated that thousands of pounds of sulfuric acid, ethyl alcohol, and millions of gallons of washing water would be discharged into the Ohio River. Hundreds of pounds of cotton might also be discharged. . . . In addition, there was domestic sewage from the plant that had to be considered in sewage planning" (Stoner and Field [1942]:32). Sufficient treatment of the materials discharged into the river was made doubly necessary since the Ohio was the source of municipal water supplies for both Louisville and New Albany. Treatment of domestic sewage at the IOW #1 included primary sedimentation, sludge digestion, and sludge beds (Stoner and Field [1942]:35, 38-39).

Neither Du Pont nor the state board of health had dealt with river pollution from an industrial facility of this size and type before. Originally, since the plant would go into operation slowly, one stage at a time, they agreed to simply monitor the river as well as Lick Run and Jenny Lind Run, through which the wastes would be discharged. A means of treating materials having adverse effects would be developed as discovered. As the size of the plant was increased from two to four, then six lines, steps were taken to treat the wastes. Settling pools were installed to neutralize acids, and Du Pont developed ways to reclaim much of the alcohol used at the facility. In response to complaints about bad odor and taste, attributed to the alcohol which was discharged into the river, tests were conducted above and below the point of entry. There was no significant difference in the results, and analysis by the state board of health failed to show any deleterious effects due to alcohol (Stoner and Field [1942]:35, 38-39).

Another source of pollution were the two power plants at IOW #1, both coal burning systems, that released a great deal of particulate matter and produced sulphur dioxide gas. In 1970 the plant was cited as a major source of air pollution in the area, creating a haze that often hung over the plant and drifted into Charlestown. "Many Charlestown residents are unhappy about it. Along High Street, which runs parallel to Ind. [sic] 62, particles of black soot and dust settle on houses and cars, and blow in through open windows during warm weather. The 'yellow smoke' discolors laundry. Some people complain of a faint ether-like odor in the air" (Buckler 1970:1). Five stations were set up around the plant to monitor emissions in early 1970. It can be assumed that similar emissions had plagued the area prior to 1970 as well, but no mention of the problem as been found.

EFFECTS OF THE END OF THE WAR

With the end of the war thousands were out of work in Charlestown and the surrounding area. Employees at the three units numbered about 19,000 in August 1945, and most would be laid off within the first few weeks of V-J Day. To keep the situation in the area a little less chaotic, the plants began releasing about 2,500 employees a day, beginning August 13. The exodus began immediately, with people leaving "by automobile, rail, bus and 'thumb'" (IS 1945), heading back home or, in the case of many construction workers at IOW #2, on to the next construction site. Some were already planning what to do with war bonds and other savings they had put away during the war--"I'm going right back home and open up a business and get rich"--while others just wanted a long rest (Wood 1945:2-1).

Some said that before long Charlestown returned to a semblance of the sleepy small town it had been prior to the war, except that there were a lot more people there than before (Richey, interview 1994). Others thought the area changed distinctly for the worse. For some it was the added accoutrements of any large municipality that were objectionable. "All these greedy people came in and went to work, so you had greedy judges, greedy lawyers coming out your ears, and welfare departments and doctors" (Howard, interview 1994). Others saw the change as broader, believing that the post-war population had a greater "lower class" composition, "more like food stamp [people]" (Payne and Payne, interview 1994).

The population was three times that of 1939, falling to about 3,000 after most of the former employees had left (Coleman 1946:n.p.). Too few for businesses that were accustomed to the previous crowds and had

expanded to accommodate them. Sales at the drugstore run by James Botorff had increased tenfold during the war, then dropped 50 percent when the defense employees left. And G. T. Richardson, who was used to serving 1,000 meals a day in his restaurant, said that 300 meals was a good day's business at that time (Coleman 1946:n.p.). They and other local business persons hoped the town would not become the ghost town some predicted, and thought the sale of the federally funded houses at Pleasant Ridge would help avoid that fate. They saw Charlestown becoming a rural suburb of the Falls Cities area, a hope borne out when the population grew by 500, largely due to the families who came to buy Pleasant Ridge properties (Coleman 1946:n.p.).

The changing economic situation affected not only those in business. Many were used to the high salaries paid at the plants or to having two wage earners in a family. With the closing of the plants people found small luxuries less affordable, luxuries they had grown accustomed to, from new appliances to going out to eat at a Louisville restaurant. Many people had to change their way of living; farmers went back to farming, other operations employees went on to whatever jobs they could find in the area (Howard, interview 1994).

World War II gave Charlestown residents their first experience of the boom-and-bust cycle that has dominated life in the town ever since. When the plant is in operation, the economy picks up as new businesses come to town and businesses already there see sales increase, the population expands, and life in general becomes much more dynamic. And when operations cease, part of Charlestown goes on hold as well (Runquist 1992:B1).

THE POST-WAR YEARS

The three plants (IOW plants 1 and 2, and HOP) were combined into a single entity, the Indiana Arsenal, by War Department Circular Number 329 on October 30, 1945 (INAAP [1967]:1; Table 12). The Jefferson Proving Ground, 56 km (35 mi) to the north, near Madison, Indiana, became a sub-post of the arsenal in April 1946. Like IOW #1 and HOP, the proving ground had been constructed just prior to World War II. It was declared a standby facility in August 1946 (INAAP [1967]:8).

Du Pont remained at IOW #1¹⁹ until February 1946, when the unit was turned over to the government. The post-war mission of the facility was to maintain a state of readiness as a Class II Industrial Standby Installation (able to go into production on a substantial scale within 120 days of notification), and to receive, store and issue material as directed, much of it going to the igloos and warehouses at HOP. The material being stored included more than 45,359,000 kg (100,000,000 lbs) of smokeless powder, other ammunition, and War Reserve property, which included explosives, materials, and about 1,000 pieces of JANMAT (Joint Army Navy Machine Tools). The country's only Machine Tool Surveillance Laboratory was set up there in August 1950, which was responsible for maintaining all Ordnance Corps industrial machinery in storage at various installations in operating condition and capable of immediate activation (INAAP [1967]:8-9; Indiana Arsenal [1946]:13).

The facilities at IOW #1 were put to a variety of uses after the war. The government managed the plant less than half a year, negotiating a new CPFF contract with Du Pont (W-49-010-ORD-47) under which Du Pont was to begin producing ammonium nitrate for agricultural purposes on June 27, 1946, making the arsenal one of 14 plants involved in the Treasury Department's efforts concerning the European Recovery Program, or Marshall Plan. (HOP's main change house was also leased to the U. S. Department of Agriculture as a

¹⁹ Of course, IOW, or Indiana Ordnance Works, strictly speaking no longer exists. When speaking of the functionally different areas in the Indiana Arsenal, the plant records still refer to this area as "Plant 1." For ease in distinguishing between the different areas, the designations IOW #1, IOW #2, and HOP will be retained.

Table 12
Partial Inventory of Indiana Arsenal, June 1946

	IOW #1	IOW #2	HOP
Area, ha	2,003	3,346*	1,985
ac	4,950	8,268	4,904
Manufacturing Buildings	925	65	423
Magazines (Ship Houses)	111	14	0
Igloos	0	0	177
Roads (km)	105	71	140
Railroads (km)	116	6	26
Ohio River Frontage (km)	5	11	5
State Highway Frontage (km)	5	11	5

* Approximately 2,023 ha (5,000 ac) of IOW #2 had been declared surplus and were sold soon.

Source: History of Operations:14

storehouse in connection with the Marshall Plan.) The ammonium nitrate was used in nitrogen fertilizers that were sent to Germany, Japan, and other occupied territories.

Operations under this contract were far from their war-time scale, using only about two percent of the plant's production facilities. Employment reached its high of 156 persons in early 1947. Peak production was in August 1949, accomplished with a work force of only 78. This contract was terminated March 31, 1950. The same facilities were later leased to the Spencer Chemical Company, which produced ammonium nitrate for commercial sales (INAAP [1967]:2; Indiana Arsenal [1955]:2).

Portions of the arsenal were leased to other interests. Both power generating plants were let to the Public Service Company of Indiana. The main administration building at IOW #1 was used by the Charlestown Township School system for two years. Other buildings were used by Indiana University as extension facilities.

Ordnance reactivated the powder production and LAP facilities in the spring of 1946 to help build munitions reserves. First production was limited to 105-mm howitzer charges, then it was expanded to the larger howitzers and other guns, with four lines eventually put into production (Indiana Arsenal [1946]:40-63).

The HOP unit began undergoing renovations, described as deferred maintenance, in early 1951 as part of the Arsenal Industrial Mobilization Plan, and rehabilitation of IOW #1 began in the spring of 1952. The work apparently did not go smoothly, as "the early stages of rehabilitation work were fraught with jurisdictional strikes by various trade unions. An estimated 4,150 men were prevented from entering the Plant on 24 May 1952" (INAAP [1967]:3). The rehabilitation was completed in about two years at a cost of just over 59 million dollars.

While the facility was still undergoing rehabilitation it was put into operation again, producing munitions for the conflict in Korea. Sharp increases in military munitions requirements in that arena resulted in new CPFF contracts for both Du Pont and Goodyear. Leases to outside interests were suspended, terminated, or

modified, and Goodyear began working at the HOP unit in September 1951. Du Pont returned to IOW #1 the following January, producing its first smokeless powder in the fall of 1952 (Indiana Arsenal [1955]:2).

Production increased steadily as more of the plant went back on line, hitting the high point in August 1953. Employment was also at its peak that month, with 7,691 persons on the payroll. This period of activity was short-lived, and in February 1954 the second shutdown began. The layaway program was completed on November 1, 1955, all buildings then being designated under standby or caretaker status. Minimal production continued until the last lot of powder was packed in September 1957 and the arsenal was placed on inactive status by Department of the Army General Order (DAGO) Number 53 (INAAP [1967]:3-4).

A comparison of production during World War II and the Korean War clearly indicates the vast improvements made in the efficiency of bag-loading operations by Goodyear as they put to use lessons learned during World War II. Thirty-two percent less labor was required for a greater production volume (Table 13). As pointed out in the operations section, the performance of the HOP unit surpassed all other bag-loading plants during World War II (INAAP [1967]:12).

Table 13
Production Figures for World War II and the Korean War, HOP

	World War II 9/41 - 8/18/45	Korean War 9/17/51 - 9/20/57
Smokeless Charges	103,764,926	106,220,174
Black Powder Charges	12,416,244	29,813,770
Fabric Used (sq m)	42,791,071	46,221,588
Smokeless Powder Used (kg)	236,689,300	277,388,940
Black Powder Used (kg)	3,349,191	4,008,166
Number of Bags	568,079,105	600,113,896
Person Hours	24,158,416	16,487,021

Source: INAAP [1967], p. 12.

Goodyear took over maintenance of the powder plant for a short while in 1959, then Liberty Powder Defense Corporation, a subsidiary of Olin Mathieson Chemical Corporation, took up the same responsibility at the end of the year. Liberty was dissolved by the parent company at the end of 1961, and Olin assumed its contractual obligations.

Due to U.S. involvement in the conflict in Vietnam, the arsenal was again made active August 23, 1961. This time the mission, in addition to the former powder production and LAP specifications, involved debagging, drying, blending, and cross blending propellant used to load charges. Work at the HOP unit began on the first of November 1961, the same day the plant was redesignated the Indiana Ordnance Plant. Production started at the IOW #1 unit in January of the following year. Output gradually increased throughout 1963. In August of that year the name of the plant was changed one last time to the present Indiana Army Ammunition Plant (INAAP [1967]:5-15).

The work force increased steadily throughout the 1960s, production growing along with it. But in 1968 there was a setback, the largest labor relations problem in the plant's history. Contract negotiations with the International Chemical Workers Union had bogged down so, on October 7, two thousand members of Locals 761 and 292 set up pickets. The strike continued for three weeks and grew to involve 15,000 workers,

virtually the entire labor force. It was serious enough to get the attention of the Pentagon, which would likely have invoked the Taft-Hartley Law to force the workers back on the job had there not been sufficient short-term munitions stockpiles. The workers voted to accept a more favorable contract offered by Olin at the end of October (INAAP [1968]:clippings from the *Charlestown Courier* and *The Evening News* attached to pp. 31, 41, and 50).

United States involvement in Southeast Asia decreased during 1970, with reverberations in Charlestown. "In fiscal 1970 the I[N]AAP employment dropped from a peak of 19,000 people to approximately 12,000 people. This had a corresponding impact on the local unemployment picture which showed an increase of 1.1 percent of the work force being unemployed in an area of much industry." The trend continued in 1971 as an additional 7,500 people were let go. "Although it was evident that the majority of these layoffs were females [who accounted for 61 percent of the work force and held 84 percent of the production jobs] who chose to take an optional layoff in lieu of using their seniority [to move] into general purpose and lesser paying jobs, the unemployment rate for the immediate area made a decisive jump from five percent to 11.2 percent in Clark and Floyd counties" (INAAP [1971]:16), from which the INAAP was drawing over fifty percent of its work force. The plant was putting about 4.5 million dollars a month into the local economy during the latter half of 1969 and first half of 1970; the figure dropped to about 1.5 million during the ensuing 12 months. The official word at the plant was that the work slowdown was having little effect on life in the locality. "There has been no significant publicity regarding the impact that the sharp reductions have had on retail sales in the area. Shopping centers, recreation and housing areas continue to flourish and grow despite the fact that the defense cutbacks at the I[N]AAP continue" (INAAP [1971]:16).

ICI Americas Inc. took over operations and maintenance at the plant on May 1, 1972. ICI Americas, a subsidiary of Imperial Chemical Industries PLC, located in London, England, has its headquarters in Wilmington, Delaware. In 1972 the parent company was Britain's largest industrial company and, at the prevailing exchange rates, the largest chemical company in the world. It then had 350 subsidiaries in all major and most non-industrial countries. The company is involved in the manufacture of a wide range of products, including plastics, fibers, pharmaceuticals, paints, and of course explosives (Roeber 1975:7-10). ICI Americas is the current operator.

In mid-1975, work force reductions at the plant were again being held at least partially responsible for increasing unemployment. The June 1974 unemployment figure for Clark and Floyd counties had fallen to 5.7 percent. June 1975 estimates were as high as 11 percent (INAAP [1975]:1). Operations since that time have been minimal, with some bags being produced for forces fighting in the Persian Gulf War (Runquist 1992:B1). The plant is now entirely shut down and scheduled for closure.

SUMMARY AND CONCLUSIONS

The INAAP originally consisted of three separate manufacturing and processing areas. E. I. du Pont de Nemours & Company began purchasing land for the Indiana Ordnance Works (IOW #1), the first of the World War II-era GOCO industrial facilities to receive funding, in mid-1940. Since Du Pont acquired the land then sold the entire area to the government as one large tract, few records regarding the purchase of the individual tracts are now among the government documents archived at the facility. These records may be located in the Du Pont archives at the Hagley Museum and Library, Wilmington, Delaware. The most likely location of this information would be Accession 1305, No. 414, "Real estate (history, memoranda, etc [*sic*]) 1940-42" (personal correspondence, Marjorie G. McNinch to author, June 29, 1994).

A few months after construction of IOW #1 got underway, design work for the Hoosier Ordnance Plant, a bag loading facility to the south of IOW #2 was initiated. The firm of Shreve, Anderson and Walker, Engineers and Architects, headquartered in Detroit, Michigan, were hired to design the facility. Although little information regarding the background of this company was located, this shortcoming is not considered

to be detrimental to the historical record since adequate evidence of the role the company played in the project was located.

The impact of the sharp rise in population in the area, particularly in Charlestown, during construction and the beginning of the operations era has been well documented by the research of J. E. Stoner and O. P. Field of the Indiana University Bureau of Government Research. The impact during those early years was significant but seems to have not been a greatly deleterious influence. However, newspaper reports and a diary entry from near the end of the war indicate that during the last year of operations and with the third influx of workers, who arrived to build the rocket propellant addition to the Indiana Ordnance Works, indicate perhaps a fairly drastic change. Charlestown may be a good subject for a study of the effects of long-term boom conditions. The Indiana University Bureau of Government Research, Bloomington, Indiana, would likely have documents pertinent to such a study.

As the draft took more of the traditional male labor force away from industrial production, GOCO facilities around the U.S. turned to women and, to a lesser degree, African-Americans as means of replenishing the industrial ranks. Few statistics related to the numbers of women and blacks employed at the plants during construction and operations were located. Some figures may exist in the Du Pont archives at the Hagley Museum and Library, but indices of IOW material sent to GMI by the Manuscripts and Archives Department do not list any obvious sources of this information. Prior to the beginning of this project the position of Archivist for the Goodyear Tire & Rubber Company, the World War II-era operator at HOP, was eliminated and the records in Goodyear's archives were scheduled to be transferred to the University of Akron, Ohio. No one was available to give information about the content of the records or whether they would contain personnel data concerning employees at HOP.

And finally, a note regarding the records archived at INAAP. The holdings there are quite extensive. They include a complete photographic record of all land and structures acquired for HOP and IOW #2, numerous documents dealing with a variety of subjects concerning production and operations at the plants, and many photographs and negatives taken during construction and operations. However, the fate of these items is uncertain. Many still exist only due to the efforts of a few employees, now retired. An effort to transfer a selection of the more important materials to a more permanent collection should be made.

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Anonymous

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